COSMOLOGY AND THE COSMOPOLIS
Planetaria in the Weimar Republic

by

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Abstract

Cosmology in the Cosmopolis: Planetaria in the Weimar Republic traces the invention and subsequent popularization of the planetarium in Germany from 1923 to 1940, with particular focus on the three most celebrated planetaria in Munich, Jena, and Berlin. Literature on the history of planetaria is scant, and much of what does exist is limited to an institutional history of the invention of the planetarium projector by the Carl Zeiss Optical Company in 1923. In contrast, my dissertation contextualizes the planetarium within the urban cultural landscape of the Weimar Republic and the early years of the Third Reich. The early planetarium, I argue, encapsulated the tension between modernism and a rising conservative nostalgia for the pre-modern; on the one hand, it was a marvel of modern technology, and on the other, it was embraced as a refuge away from the city, offering a glimpse of a sky obscured by modern artificial light. My goal is thus two-fold: first, I situate my work as a critical intervention into the dominant narrative of the planetarium's role in the history of astronomy; and second, I argue that a focus on the planetarium as a popular site of spectacle and education in the Weimar period offers a crucial perspective for understanding the relationship among cultural forms, scientific discourse, and nationalism in urban spaces. The planetarium emerges as a site in which conflicting ideas about modernity, nationalism, and the public were contested.

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Primary readers: Ruth Leys and Peter Jelavich

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Contents

Introduction

The year is 1931, and a young man's father has come to visit his son in Berlin for Christmas. The son, despairing of an activity that both he and his father will enjoy in the damp and dark of late December, takes his father to the Zeiss Planetarium at the Zoologischer Garten. The man running the planetarium projector is affable and enthusiastic and offers to perform a little trick for the father-son duo. "What time were you born?" he asks the son. "I can show you precisely how the sky looked that night."[1] The son tells him he was born on 13 March, 1896, and the planetarium worker quickly sets the machine to spinning, moving swiftly back through the years. The machine settles, and the son is agape, marveling at the incredible sparkling sky that suddenly appears overhead. His father, however, is less pleased. "A racket!" he scoffs, "An absolute, nasty scam! It rained so hard that night, you couldn't see a single star at all!"[2]

This joke appeared in the weekly humor magazine *Ulk* under the title "ZEISS TELLS A FIB," and the modern historian can find it carefully preserved in a folder of newspaper ephemera labeled "Planetarium Humor" at the Carl Zeiss Optical Company headquarters in Jena, Germany. We find other planetarium jokes in the same collection. In one cartoon from 1935, an old woman charges ten pfennig to a gullible young couple one evening, promising them an "Open Air Planetarium" – all they have to do after paying, she says, is look up.[3]

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[1] "ZEISS FLUNKERT," in "Ulk," *Berliner Tageblatt* (December 1931), in ASTRO 0288, Carl Zeiss Archives.
[2] Ibid.
[3] "Das Planetarium im Humor des In- und Auslands," *Zeiss-Werkzeitung* 6 (2, May 1931).

Another common motif found in this humor collection is the cheap alternatives to planetarium shows– a man runs into a lamppost and exclaims "I didn't realize I had already arrived in the planetarium!" as stars spring up around his head.[4] In another cartoon, a man is the unwitting victim of a mechanical malfunction: he already sits in the planetarium, patiently waiting the start of a show, when the heavy dumbbell-shaped projector accidentally swings down right on top of his head, and stars explode around him. "Here's a way to see the stars in the planetarium!" the caption explains.[5] In another, one man punches another soundly in the head outside a Zeiss Planetarium, causing the usual stars to erupt, while helpfully explaining, "don't get me wrong dear friend! This way I'm saving you the price of admission!"[6] [*Figure 1.1*]

First successfully built in 1923 by the Carl Zeiss Company, by 1935 there were nearly a dozen planetaria in Germany alone, and increasingly more abroad.[7] Every major city had one, and total annual admission across Germany regularly exceeded two million. The planetarium was a familiar fixture of inter-war German cities. Over the course of the Weimar Republic and into the early years of the Third Reich, the Zeiss Company collected reams of poems, short stories, reviews, articles from abroad and at home, along with images and cartoons, all centered on the planetarium and its extraordinary abilities. But alongside these jokes and cartoons in which the butt is both the planetarium's promise and the people gullible enough to buy into it, we also find praise and adulation, in styles both academic and melodramatic.

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[4] Ibid.
[5] Ibid.
[6] Ibid.
[7] Untitled spreadsheet of planetaria, 1933, in BACZ 2259, Carl Zeiss Archives.

One particularly memorable piece of writing is a "starry fairy tale" written in the late 1920s by a Frau Petersen in Jena, in which she imagines the angels of heaven feeling curious about the strange new buildings taking shape all over Germany. The angels disguise themselves as humans and sneak into the Jena planetarium, where they are astounded by the performance and also jealous, because "they could not bear […] the idea that the inhabitants of earth should be able to possess something in advance of Heaven."[8] The angels, aided by the spirit of Zeiss Company co-founder Ernst Abbe, build a heavenly planetarium, which labels all the celestial bodies in the sky, allows the angels to rotate the earth as much as they like, and projects a great pointer arrow onto the starry scene. The humans, witnessing these enormous phenomena, become collectively convinced that the apocalypse is nigh and promptly descend into chaos; eventually God himself has to intervene and dissolve the heavenly planetarium to dust.

A poem by an amateur poet from Saxony in 1939 reaches similar literary heights:

[…]	[…]
Du ließest Mutter Erde tief im Rücken	You left Mother Earth behind
und schaust dich um, du Raumes Überwinder:	and look around, you conqueror of space:
da siehst du die Planeten mit Entzücken	see the planets, with delight,
um ihre Sonne wie den Kranz der Kinder	around the sun, like a wreath of children.
Wie deine Sinne noch bewundernd stocken,	How all your senses are stunned in wonder,
schwingt sich der alte Tag in deine Kreise –	bringing the good old days back into view,
verlöscht die Wunder, die dich ewig locken,	but then extinguish that Wonder, that entices you forever
und nimmt dich heim auf deine Sternenweise.	and make your way home along the starry path.[9]

[8] G. Peterson, "The Great Star Machine in Heaven," in ASTRO 907, Carl Zeiss Archives.
[9] Joachim Strassburg, "Planetarium: für Walter Bauersfeld," *Das XX. Jahrhundert* (Jena: Eugen Diederichs Verlag, 1939,) 490.

Thus we find a sizable and diverse body of literature in praise of a machine that the director of the Royal Danish Observatory, Elis Strömgren, called "a school, theater, and film all in one, a lecture hall under the vault of the heavens, and a drama in which the celestial bodies are the actors."[10] "No description," he continued, "no photograph, no drawing can possibly reproduce the overwhelming impression made by a demonstration in a Zeiss planetarium."[11] What Dr. Strömgren articulated in his laudatory review was a nascent feeling shared not just by other museum directors, but also by the many thousands of visitors who suddenly began to flock *en masse* to see this wonder of the heavens: that there was something special and inimitable about the planetarium, that it was unique in both the type of experience it offered and the *way* in which it offered it.

The planetarium in the Weimar period spoke to both an excitement and an anxiety about technology and modernity. Fantastically modern in many ways – its revolutionary projection technology; the architectural construction of the dome; the broadcast of music; the whirling, sweeping images – the planetarium nonetheless was a refuge for those who felt anxious in the newly modern world of post-war Germany, offering a respite from the sensational deluge and a space in which to revisit a pre-modern sky, to see stars now obscured by blinding electric lights. The planetaria of the inter-war period were sites in which conflicting and coexisting notions of technology, modernity, and what it meant to be German were negotiated and contested.

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[10] Elis Strömgren, quoted in Walter Villiger, *Das Zeiss-Planetarium* (Jena: Vopelius Verlag, 1926), 11.
[11] Ibid.

The planetarium prototype that debuted on the roof of the Carl Zeiss Company in late 1923 was the first fully mechanized immersive model of the solar system. [*Figure 1.2*] A spherical projector studded with lenses and accompanied by a cylinder of smaller projectors was mounted in the center of a large dome, allowing about 4500 stars to be projected onto the surface of the dome, along with planets, comets, and the sun and moon. An electric motor spun the projector, producing an illusion of the celestial bodies moving overhead. The entire apparatus was designed to mimic the effect of standing outside on a dark night and watching the heavens rotate above.

Very little has been written on the history of the planetarium; three full-length books in English and about a dozen in German encompass the entirety of historical accounts dedicated to this machine. One of the most canonical works on the subject is Ludwig Meier's *Der Himmel auf Erden: Die Welt der Planetarien*.[12] Meier's 1992 account is a detailed history of the invention of the Zeiss Planetarium projector, and most other studies of the planetarium in the last few decades either reference this work directly or adopt its narrative.

Meier's history begins in ancient Greece, with the Antikythera machine (an astronomical computing device) and several models of celestial globes, to illustrate how the Greeks had already attempted an accurate reproduction of the heavenly spheres. Meier then looks at several late-Renaissance and early modern astronomical models, which he reads as slightly more sophisticated versions of the older Greek models. Meier is particularly interested in two large-scale models, which to him represent the most direct

[12] Ludwig Meier, *Der Himmel auf Erden: Die Welt der Planetarien* (Leipzig: Johan Ambrosius Barth Verlag, 1992). Gerhard Hartl, director of the planetarium at the Deutsches Museum in Munich once described Meier to the author as the "king of planetarium history."

ancestors of the modern planetarium. The first is the Gottorp Globe, a four-meter diameter sphere built in 1650. [*Figure 1.*3] The exterior was painted with a map of the known world, and the interior, which could house less than five people at a time, was painted with constellations, and the entire sphere could rotate with the help of a hand crank, giving the visitors the impression of the rotating celestial sphere at night. He also focuses on the Eise Eisinga orrery from the 1780s, an elaborate mechanical model of the helioscentric solar system mounted on the ceiling of the Dutch living room of Eise Eisinga, amateur astronomer and professional wool comber. [*Figure 1.4*]

Meier then offers a more detailed history of the Deutsches Museum in Munich, and its role in the invention of the planetarium. In 1912, Oscar von Miller asked the Carl Zeiss optical company in Jena to build a room-sized Copernican model, that would, like the famous Eisinga orrery, be mounted on the ceiling. Alongside the Copernican model, which would illustrate the heliocentric system, von Miller also wanted a model that would illustrate the geocentric Ptolemaic system, in which the Earth remained stationary while planets, stars, and the sun all rotated around it in nesting orbits. In 1913, von Miller and his friend Max Wolf designed their own modernized version of the Gottorp sphere, which would give the effect of the viewer standing on a stationary Earth while all celestial bodies rotated around them, but the Zeiss company declined the project. In early 1914, von Miller and Wolf met with Walther Bauersfeld, a Zeiss company engineer, and it was in this meeting that Bauersfeld first suggested replacing stars mounted on the interior surface of the dome with a central projection apparatus. The plan was made public in 1917, but it would take almost six years for a working model to open on the roof of the Zeiss company

headquarters in Jena, and another two for the Deutsches Museum to open with the planetarium installed.

The story of von Miller and Wolf's collaboration with Zeiss is well-documented in both the Deutsches Museum and Zeiss Company archives, as is the influence of the Gottorp globe and the Eisinga orrery on their design. It is a well-known origin story among those who concern themselves with the history of the planetarium. What is curious, however, is that few of these histories consider the period of von Miller's invention independent of the larger historical narrative that Meier pieces together. Put another way, planetarium histories all rely on a teleological narrative that sees the planetarium invention as the natural and obvious culmination of millennia of efforts, beginning with the classical Greek models up until the Zeiss model, whereby the technological advances in respresenting the stars and cosmos are understood as manifestations of one and the same urge that has occupied people for thousands of years.

As Heinz Letsch writes in his 1949 technical text *Das Zeiss-Planetarium,* "The sublime beauty of the starry world and the remarkable rhythm of heavenly motions has for millennia made a deep and lasting impression on feeling and thinking men."[13] Alison Griffiths, a media studies scholar, remarks in her 2008 book *Shivers Down Your Spine: Cinema, Museums, and the Immersive View*, that, "a fascination with the sphericity of the earth and the universe … has long captured the imagination of scientists, physicists, and astronomers."[14] Franz Fieseler, a Zeiss employee concerned with advertising the planetarium, wrote in 1936 that "the Zeiss Planetarium is what until its advent none had

[13] Heinz Letsch, *Das Zeiss-Planetarium* (Jena: Gustav Fischer Verlag, 1949), 5.
[14] Alison Griffiths, *Shivers Down Your Spine: Cinema, Museums, and the Immersive View* (New York: Columbia University Press, 2008), 119.

ventured to hope for."[15] Perhaps the clearest expression of this view is found in the first few sentences of Jordan Marché's 2005 monograph *Theaters of Time and Space,* when he writes that "human attempts to create models of the universe extend back to antiquity and beyond," but, he continues, "oddly enough, a full realization of this goal had to await the arrival of the twentieth century."[16]

In all these various approaches and despite their methodological differences, the planetarium is seen as an expression of an age-old desire to perceive and understand the heavens; it is the most technologically advanced attempt, and perhaps the most successful, but certainly not the first. Marché himself even goes so far as to suggest that the planetarium was waiting until technology was advanced enough to produce it.

These accounts always note the changes in planetarium design and engineering over time, from Zeiss's first clunky 1923 Mark I prototype, to the dumbbell-shaped behemoths of the 1926 Mark II through the Mark VI of the 1970s, to the egg-shaped "Starball" design of the Mark VI of 1993, to the current model, the Mark IX. However, despite their attention to the shift in how the planetarium functioned as a machine, these accounts generally leave to the side the larger question of how the planetarium functioned as a place – how its directors saw its purpose, and how the public engaged with it. The tendency towards a teleological narrative is linked to an assumption that the planetarium has held essentially the same significance at all times for all people. The root of both of these interpretations is

[15] Franz Fieseler, "The Zeiss Planetarium, its genesis, and its cultural value," 1935, 6; in ASTRO 910, Carl Zeiss Archives.
[16] Jordan D. Marché III, *Theaters of Time and Space: American Planetaria, 1930-1970* (New Brunswick, NJ: Rutgers University Press, 2005), 9.

a belief that humans have always wanted to see the stars, and will fulfill this desire in whatever way they can.

However, this framing fails to account for the planetarium as a distinct, historically-specific cultural phenomenon that embodies a particular relationship between science, the public, and space. Its rise and popularity are intimately interconnected with the history of the interwar city. The planetarium was, in its early years, an explicitly urban experience, a product of a specific historical moment marked by uncertainty and disorientation. What planetaria offered to their visitors in the interwar period, and how visitors engaged with them, was not exactly the same as what the modern planetaria offer.[17]

Furthermore, the planetarium was, in these first two decades, largely a German experience; its invention, its popularization, and its development were all conditioned by the cultural, historical, and political realities of inter-war Germany. Some recent accounts of planetaria have accounted for this to a limited agree; the edited volume *Die Welten Maschine: Beiträge zur frühen Geschichte des Zeiss-Planetariums Jena*, for example, contextualizes the Zeiss company's flagship planetarium in Jena in a deeper history of the Zeiss company itself, as well as the contemporary intellectual milieu of Jena.[18] Nonetheless, it positions itself largely as a compendium of technical history; the contributions offer more detailed accounts of how various components of the planetarium

[17] A notable exception to this prevailing perspective is Charlotte Bigg's recent article in *Early Popular Visual Culture*, in which she considers early twentieth-century planetaria, distinct from post-war planetaria. She argues that these early planetaria "encouraged the rehearsal by spectators of different spatial positions and bodily relationships with regards to (models of) the solar system" as a way to teach astronomical phenomena. Charlotte Bigg, "The view from here, there and nowhere? Situating the observer in the planetarium and in the solar system" in *Early Popular Visual Culture* 15 (2, Summer 2017), 204-226, here 204.

[18] Ernst Abbe Stiftung, ed. *Die Welten Maschine: Beiträge zur frühen Geschichte des Zeiss-Planetariums Jena* (Jena: Ernst-Abbe Stiftung, 2010).

came about, but it remains highly localized and relatively uninterested in the larger cultural and political contexts of the planetarium.

This dissertation draws on this extant literature but considers the planetarium not as part of a technical history of models stretching back to antiquity, but as a culturally, historically contingent phenomenon of inter-war Germany, between 1923, when it was invented, until the early 1940s, when the Third Reich was at its height. The focus of this dissertation is not the technological evolution of the planetarium, though that plays a part, but rather how the planetarium in this period sat at the intersection of coexisting and competing discursive threads – technology, nationalism, modernity, and space. The planetarium emerges as a site that is both educational and entertaining, thrilling and comforting, disorienting and grounding, and one in which the concept of Germany is explored and articulated.

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If the Gottorp globe and the Eisinga orrery were the technical inspirations for von Miller's planetarium vision, we might turn to other examples as models of the kind of experience the planetarium offered. In thinking about the immersive quality of the planetarium – the sense it gave its visitors of all-encompassing darkness and space -- the panorama of the nineteenth century is a notable reference point. The panorama, as Stephen Oettermann details in *The Panorama: History of a Mass Medium*, emerged in the late eighteenth century from new ways and technologies of seeing.[19] The new technology of hot air balloons, as well as the increased interest in landscapes in painting, and the horizon

[19] Stephen Oettermann, *The Panorama: History of a Mass Medium*, trans. Deborah Lucas Schneider (New York: Zone Books, 1997).

in navigation, all contributed to an interest in producing large-scale reproductions of natural landscapes that were meant to mimic the effect of actually being in that environment. The illusion of the panorama was not absolute; many panoramas were clearly large painted scrolls, with little attempt to convince the viewer that they were truly present in the depicted environment. However, as the nineteenth century progressed, panoramas often became increasingly elaborate, with artificial flora and fauna carefully staged between the viewers and the panoramic surface, and darkened rooms which obscured anything beyond the intended display. These panoramas were meant to produce an immersive illusion, a sense of really being there. As Oettermann notes, panoramas in the nineteenth century were particularly devoted to reproducing a scene as accurately as possible, down to the precise placement of trees, shrubs, and stones. In both the composition of the panoramic painting and in the construction of the artificial terrain, "everything […] was dictated by the need to reproduce reality as closely as possible."[20]

We find an echo of this sentiment in the praise for the planetarium's immersive and reproductive qualities. In responses to the planetarium's early performances in Jena, there is a repeated insistence that the scientific accuracy of the projection is so exact that scientists find themselves unexpectedly moved. As Waldemar Kaempffert, the science editor for the *New York Times* reported, "even trained astronomers who know exactly what to expect cannot suppress a long-drawn "ah-h-h!" of astonishment."[21] Ingalls claims that the audience always gasps in amazement: "You can hear it ripple across the room and back,

[20] Oettermann, 51.
[21] Waldemar Kaempffert, "Now America Will Have a Planetarium," *New York Times*, 24 June 1928.

a genuine kind of 'Ahh.' […] Even a case-hardened professional astronomer will say it under his breath."[22]

While the planetarium's capacity for immersive illusion is in many ways an echo of the panorama, it is set apart by its dynamism, and its theatrical quality. The planetarium was not, as so many of the panoramas were, a static site, but one that was constantly in motion. It also spectacular in a way the panoramas never fully achieved – flashy, bright, and performative – while also promising an educational experience. To think more closely about this relationship, between entertainment and education, we might look at a remarkable but little-known device called the Eidouranion Orrery, which was shown to great acclaim on the stage of the Lyceum Theater in London, for about fifty years around the turn of the nineteenth century. The Eidouranion was the invention of the instrument maker Adam Walker and his sons, and unlike its table-top contemporaries, the Eidouranion Orrery was composed of a series of moving slides projected onto a screen which faced the audience and extended from the floor of the stage up to the upper curtains.[23]

The slides included elaborately illustrated images of the zodiac as well as detailed sketches of orbital paths of planets, comets, and moons. The final scene, added sometime before 1820, was of "The Probable Construction of the Universe," in which "The Sublime and awful Simplicity of Nature is daringly imitated."[24] This performance was accompanied by music from the "Celestina," another device invented by Adam Walker, which imitated

[22] Albert G. Ingalls, "Canned Astronomy: What the New Planetariums for Chicago and Philadelphia Would be Like," *Scientific American* (Sept 1929), in ASTRO 907, Carl Zeiss Archives.
[23] William Walker, "An account of the eidouranion; or, Transparent orrery; Invented by A. Walker, of Conduit Street, Honover Square; as lectured upon by his son W. Walker. with the new discoveries," (Manchester: J. Harrop, 1795).
[24] Ibid.

"the music of the spheres." This final scene differed from all the others by radically altering the position of the viewer. For the preceding scenes, the audience views the heavenly mechanisms as if from above, but in the final scene, the viewer is suddenly brought back to Earth, presented not with a view from above but a view from underneath — how the sky would look if all heavenly bodies were visible from earth. The milky way stretches across the canvas, "powdered with stars," bearing an uncanny "resemblance to nature."[25] [*Figure 1.5*]

The Eidouranion Orrery is remarkable for its combination of scientific attention (the Walker family corresponded regularly with William Herschel to confirm their claims about nebulae and planetary motion) and its theatricality. The vertical orrery was a design not seen before or since, and by all accounts was one of the most popular Lyceum offerings.[26] The Orrery shared the gilded stage of the Lyceum with magic shows, animal tricks, illusions of all types. In the two extant depictions of the Orrery, the theater is crowded and chaotic, with spectators surging forward in their seats to get a better view.

Almost no histories of astronomical instruments or London theaters tackle the Eidouranion Orrery as more than a brief aside. Nonetheless, it serves as a useful precursor to the planetarium for our interests, in that its creators intentionally positioned it as both educational and entertaining, and placed it in a distinctly urban environment, surrounded not by other scientific lectures, but spectacles and distractions of all types. There is a well-established history of scientific spectacle that examines theatrical performances of science from public physics and chemistry experiments in the eighteenth century to World Fairs of

[25] Ibid.
[26] Simon During, *Modern Enchantments* (Cambridge, MA: Harvard University Press, 2005), 219.

the nineteenth century, up through twentieth-century science fiction.[27] What is unique about the Eidouranion Orrery is both the intentionality of its creators and the sheer scale of the apparatus. While most late-eighteenth century displays of public science relied on chemical apparatuses or physical devices on a tabletop in front of a lecture hall, the Eidouranion spanned the entire breadth of a West End stage. Furthermore, its home at the West End Lyceum made it accessible to spectators who would not necessarily find themselves attending a physical demonstration in a laboratory or university lecture hall. Its pedantic and entertaining qualities were intentionally balanced.

We see this made explicit in the frontispiece of the surviving pamphlet in which a description of the apparatus's performance is given, which offers two brief epigraphs. The first is Ovid, proclaiming in the *Metamorphoses* that "Os homini sublime dedit, coelumque tueri / jussit, et erectos ad sidera tollere vultus " ("Man looks aloft, and with erected eyes / Beholds his own hereditary skies").[28] The second is a simple claim: "Stars teach as well as shine!"[29]

We find similar descriptions of the Zeiss Planetarium more than a century later. In 1935, Franz Fieseler writes that the planetarium "is an unprecedented means of instruction and a place of wholesome entertainment."[30] Max Wolf, one of its original designers, reflected in 1927 that the planetarium "has grown to be a popular means of education almost without parallel in any branch of learning within the history of man; a means of

[27] To begin with, see Bernadette Bensaude-Vincent, and Christine Blondel, *Science and Spectacle In the European Enlightenment* (Aldershot, England: Ashgate Pub., 2008) and Martin Willis, ed., *Staging Science: Scientific Performance On Street, Stage and Screen* (London: Palgrave Macmillan UK, 2016).
[28] Ibid. John Dryden's translation.
[29] Ibid.
[30] Fieseler, 9. (see footnote 12)

education, moreover, which does not dishearten but which fascinates by the enjoyment it provides."[31] More succinctly, Albert Ingalls, an American amateur astronomer who was one of the first international visitors to the Zeiss Planetarium, wrote that "the Planetarium is a good show. […] Intrinsically the performance is aesthetic. It provides thrills while it educates."[32]

The claim that the Zeiss planetarium is capable of educating while thrilling is one of several related major themes we see in planetarium literature from the first two decades of its existence. The dual ability to "teach as well as shine" is one, and the scientific astonishment at the immersive accuracy of the projection is another. Alongside these themes, we also see a repeated description of the appearance of the artificial sky as a kind of magic. The editor of *Scientific American*, visiting Jena, reported that ""the confining dome retreats to infinity. [How] perfect is the verisimilitude. The dome seems to vanish by magic."[33] Kaempffert wrote that when the projector is turned on, "a miracle happens. A switch has been thrown, and that cerulean vault suddenly becomes a firmament of twinkling stars."[34] A British visitor to Berlin wrote that "The sun, the moon, the planets and all the stars that one can see blaze up suddenly out of the darkness with an eerie but awe-inspiring naturalness. The walls seem to have been removed by magic hands and the starry, deep-blue canopy of the heavens is apparently stretched out in infinite space above us."[35]

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[31] "Prof. Max Wolf's Opinion of the Zeiss-Planetarium," in ASTRO 907, Carl Zeiss Archives.
[32] Ingalls, 6.
[33] Quoted in Marché, 17.
[34] Kaempffert, "Now America Will Have a Planetarium."
[35] Otto D. Tolischus, "Seeing Stars" *The World's Work* 55 (1927), 96-97.

Related to this language of magic and miracles is a repeated insistence that the scene produced by the projector is astonishingly true to life, so much so that you might forget where you are. Kaempffert again, reports that, "In some incomprehensible optical way you have been transported out into the open on a marvelously pellucid night."[36] A visiting grandmother is apocryphally reported to have exclaimed, when the house lights were dimmed and the stars appeared, "Oh, look! Look! They've somehow taken the whole dome away!"[37]

Despite the claims to verisimilitude, the planetarium produced an image of the sky unlike any observable in nature. In *The Genesis of the Copernican World*, Hans Blumenberg wrote of the planetarium that it "is a sort of temporal telescope, which puts the static heavens in motion and by means of technical projection makes visible things that were never seen, that were really only disclosed by comparison of observations."[38] Many observers explicitly praised this ability: being able to see the stars whirling overhead, a thousand years into the past, or a thousand years into the future contributed to the feeling of exhilaration, of drama, that the planetarium engendered. One of the most popular performances in the mid-1920s, in fact, was a show called "The Year in a Manner of Minutes," in which the projector was rotated faster and faster, until an entire year's worth of rotations was completed in only seven minutes (a day every twelve seconds). As the original designer Max Wolf wrote, "the sky is, so to speak, made accessible to experiment, and one does not need to wait for the course of the natural cycles. They are brought about

[36] Kaempffert, "Now America Will Have a Planetarium."
[37] "Das Geheimnis des Kreisels, Erde: Ein Stern-Schauspiel im Städtischen Planetarium Dresden," 1930, in BACZ 61466, Carl Zeiss Archives.
[38] Hans Blumenberg, *The Genesis of the Copernican World*, trans. Robert Wallace (Cambridge, MA: MIT Press, 2000), 119.

at will."[39] Ingalls reflected that this whirling through time and space was "bizarre." "We shall see things," he wrote, "no man has ever seen in reality or ever will see. We shall take the universe to pieces."[40]

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It is almost a cliché at this point to say that one of the central characteristics of modernity is the omnipresence of artificial light, which turns "night into day," and which both obscures the natural world and illuminates things best left in the shadows.[41] As Siegfried Kracauer wrote in *Die Angestellten* in 1930, the artificial light of the city "serves not at least to increase the darkness."[42] Or as one bourgeois cultural commentator more explicitly wrote in 1927, access to nature "is today cut off by towering skyscrapers and blinding advertisements for chewing gum and cigarettes."[43] The darkness of the planetarium, and its silence, offered a respite from this constant stimulation.

The unclouded sky in the planetarium dome was impossible to see in the modern city; the image of an "ancient sky" was repeatedly invoked instead — a sky which could only ever exist in a place devoid of light pollution. The notion of a "primeval sky" recreated by the behemoth machine is a recurring theme in planetarium literature in the interwar period. Many of the most popular shows in Germany in this period reproduced ancient skies, giving the heterotopic quality of the planetarium a temporal dimension; "The Star of Bethlehem," for example, debuted in 1934 and recreated the sky as it would have appeared

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[39] "Geheimrat Wolf über das Zeiss-Planetarium," in ASTRO 907, Carl Zeiss Archives.
[40] Ingalls, 6.
[41] See, for example, Wolfgang Schivelbusch, *Disenchanted Night: the Industrialization of Light in the Nineteenth Century*, trans. Angela Davies (Berkeley: University of California Press, 1995).
[42] Siegfried Kracauer, *The Salaried Masses: Duty and Distraction in Weimar Germany*, trans. Quintin Hoare (London: Verso, 1998), 90.
[43] Tolischus, 96.

the night of Jesus's birthday, complete with a brightly twinkling star of Bethlehem, which the lecturer suggested might be a supernova, or might, in fact, truly be a "holy wonder."[44]

But one of the most extraordinary shared elements of the planetarium shows, propaganda, reactions, and other ephemera, from this period is the repeated articulation of the planetarium as a specifically German invention, from its conception, to its construction, to its popularization. Von Miller himself originally imagined the planetarium as a jewel in the crown of his Deutsches Museum, a "temple of glory" to the technical genius of the German people. The Zeiss Company repeatedly positioned its manufacture of the planetarium as a renaissance of the German romantic tradition, begun in Jena with Goethe, Schiller, and others, and revived by the Zeiss company's "wonder of Jena." Even in the cosmopolitan center of Berlin, the planetarium offered itself as a fantastical refuge away from the bustle of the city, in which visitors could relax in a fictional German countryside of open spaces and dark skies. One of the most explicit fantasies of this kind comes from an incredibly popular 1939 show, "Appearance and Being in the Movement of the Planets," ("Schein und Sein im Wandel der Planeten"), which reproduced the sky as it appeared in northern Germany thousands of years ago, when the origin myths of the "alt-Germanen," the original Germans, were created.

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The construction of an artificial German countryside, free from the stifling and overwhelming stimulation of the city, speaks to a larger history of German nature and the concept of *Heimat*, or homeland. Germany in 1923 was still a relatively new country; the

[44] "Der naturwissenschaftliche und kulturgeschichtliche Hintergrund des 'Sterne von Bethlehem,' von Prof. Dr. Hennig, Düsseldorf," January 1934, in BACZ 27427, Carl Zeiss Archives

southern region of Bavaria had only been officially united with the larger Prussian empire, to form the German Reich, in 1871 by the efforts of Otto von Bismarck. Walter Lacqueur, in his classic study *Young Germany: A History of the German Youth Movement*, has noted that Germany in the last three decades of the 19th century was fractious and unsteady.[45] The *Wandervogel* youth movement emerged as a response to this cultural uncertainty, and devoted itself to the construction of a unified German heritage that was deeply romantic and tied to the soil. The rise of the *Wandervogel* and other similar movements was borne by the reinvigoration of the early 19th-century concept of *Heimat*. The modern connotations of *Heimat*, as Celia Applegate describes in her seminal work on the subject, emerged as part of the late-19th century "attempts to understand and reshape the German locality."[46]

The late-19th century preoccupation with *Heimat* found its fullest expression in the rise of nature conservationist movements, which "asserted that nature conservation served a real purpose: guarding the roots of national character and stabilizing the society."[47] In the aftermath of World War I, when the Versailles Treaty reshaped the borders of the Reich, the connection between German identity and the land was intensified. This period also saw the rise of government-supported *Heimatpflege* and *Denkmalpflege* organizations, which saw the task of preserving German nature as that of preserving an essential element of German culture itself.

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[45] Walter Lacqueur, *Young Germany: A History of the German Youth Movement* (New York: Basic Books, 1962).
[46] Celia Applegate, *A Nation of Provincials: The German Idea of Heimat* (Berkeley: University of California Press, 1990), 7.
[47] Thomas M. Lekan, *Imagining the Nation in Nature: Landscape Preservation and German Identity, 1885-1945* (Cambridge, MA: Harvard University Press, 2004), 7. See also David Blackbourn, *The Conquest of Nature: Water, Landscape, and the Making of Modern Germany* (New York: W.W. Norton & Co, 2006).

The evolution of this dedication to natural preservation in the name of German culture to the fascist obsession with "Blood and Soil" and *Lebensraum* in the Third Reich is a complicated one; the early years of the Nazi period saw an "unstable blend of racial, cultural, historical, and regional understandings of landscape."[48] Furthermore, as Jeffrey Herf and others have shown, the Third Reich had a complicated and contradictory relationship to technology, which was both an agent of cosmopolitan modernization, and also a means of sustaining and improving the German land.[49]

The planetarium, with its ability to recreate a sense of the German countryside, both of the past and of the future, is, as I show in this project, part of this contested discursive and literal landscape of German identity. Its inventors and manufacturers proudly considered it a paragon of German technological mastery, but also of German romanticism and idealism renewed for a modern age, a new "Wonder of Jena." This modern Wonder was an essential feature of the modern urban landscape, at the same time that it evoked a deeper, older history, rooted in the soil.

Few studies of the planetarium engage with its German cultural context aside from a note about the economic realities facing Zeiss after the Versailles Treaty's harsh curtailments on manufacturing, or von Miller's relationship with the Kaiser and the Bavarian royal family. The most recent published study of the planetarium comes closest, perhaps. Hans-Christian von Herrmann's edited volume *Zum Planetarium: Wissensgeschichtliche Studien* is a comprehensive look at the planetarium from a media studies perspective. The contributions to the volume consider the planetarium in relation

[48] Lekan, 261.
[49] Jeffrey Herf, *Reactionary Modernism: Technology, Culture, and Politics in Weimar and the Third Reich* (Cambridge, UK: Cambridge University Press, 1986).

to other modes and technologies of seeing – IMAX theaters, stereo comparators, telescopes, and cameras, among others. In his introduction, von Herrmann calls the planetarium a *Grenzobjekt* - a boundary object between the "living world of the modern city" and outer space.[50] Nonetheless, von Herrmann's volume is focused on the planetarium as a modern media form, with less attention given to the historical context of its formation.

I approached this project with a simple question in mind: why did the planetarium appear when it did, and how did it survive? For many extant planetarium histories, because they understand the planetarium as the realization of a teleological arc of astronomical mechanical progress that speaks to an essentially human desire to commune with the stars, the planetarium was inevitably successful. How could it not be, if humans, as Marché suggested, have been waiting for its arrival since they first looked up at the night sky? However, if you consider the planetarium within the history of other optical marvels of the long nineteenth century, you can easily imagine an alternate history in which the planetarium, like the Eidouranion Orrery and so many other optical delights that came before, fizzled into obscurity, collecting dust as a novelty artifact in the bowels of the Deutsches Museum. Instead, the planetarium flourished, and evolved, so that at the height of the Cold War, planetaria were a ubiquitous feature of the public scientific community. This project focuses narrowly on the early decades of the planetarium, in the country in which it was invented, to understand how the planetarium came to be one of the most recognizable places of public astronomy.

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[50] Hans-Christian von Herrmann et al., ed., *Zum Planetarium: Wissengeschichtliche Studien* (Berlin: Wilhelm Fink Verlag, 2018), 15. This volume is the culmination of a short-term research group at the Technische Universität Berlin on the planetarium as a media form.

My study grounds the planetarium in the cultural history of Germany in the Weimar Republic and the Third Reich, from 1923 to 1940, to argue that the planetarium's development and popularity in this period is intimately connected to the competing discourses of German technology, modernity, nationalism, and space.

I focus on the three most popular planetaria of this period: the original planetarium installed in Munich's Deutsches Museum in 1925; the Jena planetarium, operated by the Zeiss company near its headquarters in Jena beginning in 1926; and the Berlin planetarium, which opened in a small corner of the Zoologischer Garten in west Berlin in 1927. Occasionally, I draw on material from other planetaria in operation during this period, both to serve as comparison and to demonstrate the well-established network of communication among planetaria at the time.

The choice of these three planetaria is deliberate; not only were they the most popular, but they were situated in local contexts that serve as excellent case studies for an understanding of the relationship between the planetaria and their urban environments. Munich, for example, had been a major cultural center throughout the nineteenth century, with aspirations to a greater role among the newly unified German states, but after 1900 fell increasingly behind the rising star of Berlin; it was also the site of a continual cultural conflict between a conservative Catholic tradition and liberalism. Von Miller and his Deutsches Museum project, while not centrally involved in this *Kulturkampf*, were nonetheless part of an ongoing debate about the future of Munich, and Bavaria, in Germany. In the first chapter, I examine the Deutsches Museum and its planetarium in relation to von Miller's larger goal of establishing a canon of German technology in his "temple of glory" to German engineering. This unifying project applied to all aspects of

the museum design and construction, from the materials covered, to the men honored in the ornate hall of fame, to the manufacturers chosen for each exhibit. The planetarium, as I show in this chapter, was a central part of this vision, as well as the relationship of von Miller and his vision to the larger cultural and political context of Bavaria.

Jena, by contrast, was a relatively provincial city, but one with a rich cultural and intellectual legacy from the romantic and idealist movements of the early nineteenth century. The Zeiss company, located in the middle of Jena's old city center, was at the center of an ongoing negotiation of the relationship between Jena's cultural heritage and its new, post-1900, scientific and technological relevance. The planetarium was a central feature of an effort by Zeiss and the city at large to rejuvenate Jena's significance as both a scientific and cultural center. This chapter argues that the Zeiss Company was intensely aware of the legacy of German culture to which it felt beholden and constructed the planetarium as part of this legacy. The Zeiss Company had, over the course of the late nineteenth century, colonized the small town of Jena, physically usurping the spaces of Jena's famous legacy as the birthplace of German Romanticism. The Zeiss Company, however, framed itself as a spiritual heir to this cultural legacy, as the next, more technologically-minded, iteration of Jena's romantic spirit. The planetarium played a central role in this framing. This chapter also examines the interest taken in the planetarium by members of the nearby Bauhaus, who found the planetarium to be an evocative site of modern shapes and technologies. In the background of Zeiss's efforts are the political undercurrents of Thuringia in the interwar period, where Communist actions in the early 1920s were later undercut by increasingly conservative and reactionary political maneuvers.

Berlin was, by 1926, a true cosmopolis – loud, bright, worldly, and modern – but this was also a recent development of the turn of the century. In the interwar period, its position as the ultimate modern city, against which other cities measured themselves, came with attendant anxieties about the risks and dangers of modernity and urban living. Situated firmly in the center of the most bustling area of Berlin, the planetarium was part of a parade of wild entertainments that stretched up and down the thoroughfare of the Kurfürstendamm. It attracted the attention of tourists, skeptics, feuilleton writers, and some of the most well-known cultural figures of the Weimar era – most notably, Walter Benjamin and Bertolt Brecht, both of whom were drawn to the planetarium's ambivalent status as a "Grenzobjekt," between modern and anti-modern. The planetarium offered itself both as a sparkling example of modern technological beauty, and as a refuge against other overwhelming stimuli. In this way, it was a slice of *Heimat* in the center of the metropolis, and sat at the intersection of modern civilization and a romantic natural world that had moved frustratingly out of reach.

The fourth chapter eschews the location-specific organization of the previous three in favor of considering the fate of all three of these planetaria during the Third Reich. Up until now, many historians of the planetarium have incorrectly assumed that planetaria suffered under the fascist regime. However, my research has shown that many planetaria survived, and sometimes flourished during the Third Reich, especially those in Munich and Jena. Nazi Party officials regularly used planetaria as meeting spaces, as training sites for military officers, and as a site of recreation. This chapter argues that the Nazi preoccupation with the land – with *Heimat*, *Lebensraum*, blood, and soil – allowed for an embrace of the planetarium, which offered a way to experience the fantasy of an ancient, beautiful German

countryside, where the heritage and the future of the German people was literally written in the stars.

The source material for this project is derived largely from two main archives – the Carl Zeiss Company archives in Jena and the Deutsches Museum administrative archives in Munich. I have also made use of archives at the Staatsbibliothek Berlin, the Landesarchiv, the Staatsarchiv Hamburg, and elsewhere. This project presented a unique research challenge, in that most planetaria of this early period were utterly destroyed during World War II. This is unsurprising when we consider that most planetaria of the period were located right in the heart of their respective cities. Most of the administrative records of these planetaria were kept on-site and were lost when the buildings burned or collapsed. However, some records did survive; all planetaria were required to send back regular reports on their operation to the Zeiss headquarters, where they were assembled into newsletters and preserved in the institutional archives. Unfortunately, the Zeiss records suffered two major disruptions that further decimated planetarium records. The first was when the Zeiss company split into West and East German branches after 1948, with the administrative archives being evenly split as well. Some records were lost during the first move. After reunification in 1991, the records from the Western branch were brought back to Jena, but in this move, even more material was lost or destroyed. As a result, no archival records remain for a majority of the planetaria in operation during the interwar period. Fortunately, Jena's records remain largely intact, and most correspondence between the Berlin planetarium and Jena has survived.

The limitations of the archival records necessitated seeking out other ways of approaching the topic. I expanded the scope of my research beyond the official archives

and spent considerable time collecting any mention of planetaria from this period from any source. I searched newspapers, feuilletons, films, radio broadcast transcripts, personal letters; I also consulted US-based archives at the Adler Planetarium in Chicago, the Griffiths Planetarium in Los Angeles, and the Hayden Planetarium in New York.

The result is that I have approached the question of the Weimar-era planetarium from many different angles, and my methodology is necessarily interdisciplinary. The actors in this story are varied – engineers like von Miller and Walter Bauersfeld feature prominently, but we also encounter a whole cast of other characters, from writers like Benjamin and Kracauer, to Nazi Party officials, to country grandmothers, to school children. The planetarium itself does not achieve agency in the way our human actors do, but there is a coproductive, co-constitutive relationship between the planetarium and its environs.

The goal of this project is two-fold. First, I provide an account of the planetarium in this historical moment; to date, no history of the planetarium or of Weimar Germany does. By contextualizing the planetarium in the cultural landscape of this period, its evolution and popularization is afforded depth and resonance. Secondly, I hope this study enriches the understanding of the evolution of the concept of Germany – its legacy, its heritage, its landscape both literal and cultural – during the fraught years between the end of the First World War and the rise of National Socialism. The planetarium, as I show here, was an integral part of an image of Germany that was at once idyllic and technical, urban and rural, expansive and close.

Chapter I: The Temple of Glory

Munich, the Deutsches Museum, and Technological Nationalism

At eight o'clock in the morning of 7 May 1925 in Munich, the Deutsches Museum was silent and empty. The finishing coats of paint were barely dry, and the final touches on the reconstruction of the alchemy lab had just been finished. The Ptolemaic planetarium, with its large, cylindrical projector from the Carl Zeiss Optical Company, had only been completely installed in the central tower eight weeks earlier. Outside, by contrast, two thousand people were gathered in the open courtyard and beyond, lining the banks of the newly-christened Museum Island in the middle of the Isar river, as they waited for the opening of the doors at ten o'clock for the Grand Opening party. [*Figure 2.1*] 7 May was a Thursday that year; rather than defer the opening of the museum until the weekend, the board of directors unanimously voted to hold the official opening of the museum on the occasion of its founder's, Oskar von Miller, 70th birthday. The occasion was so auspicious, in fact, that the board successfully petitioned the city to cancel all schools and non-essential city offices.

The grand opening was preceded by two full days of commemorative speeches and performances honoring the museum, celebrating its makers, and giving the whole city a springtime recreation of that most venerated autumnal Munich tradition. "The people," wrote von Miller in planning notes for the celebration, "should pour in like they do on Oktoberfest."[51] The festivities included a massive parade that snaked through the streets of what had been the medieval town center and up the Isar river to Museum Island, a concert

[51] Untitled memo, c. 1925, Bestell-Nr 1112/3, Verwaltungsarchiv, Deutsches Museum.

by the Munich Teachers' Choir and a small group from the Munich Philharmonic Orchestra, a pageant written and directed by German naturalist author Gerhard Hauptmann, speeches by von Miller and local Bavarian officials, and a special live radio broadcast of all three days' worth of events.

The museum that inspired this extraordinary outpouring of celebration was remarkable for several reasons. It was one of the first museums internationally to be devoted to technology, rather than only natural science; it boasted large-scale recreations of spaces such as labs, mines, and factories with which visitors could fully interact; and it featured entirely new machines meant to display scientific phenomena. One of the most remarkable of these machines was the Ptolemaic planetarium projector, intended to demonstrate the geocentric solar system model; it was developed by von Miller and engineers at the Carl Zeiss Optical Company of Jena specifically for the museum's astronomy exhibit. These immersive exhibits were unique at the time and offered museum visitors an entirely new kind of experience. The immediate popularity of the immersive rooms, especially the Ptolemaic planetarium, spawned an interest in immersion as a pedagogical and entertaining tool.

The museum also established a canon of German technological ingenuity, both in its celebration of specific German contributors to the history of science and technology, but also in its near-exclusive use of German manufacturers to produce the many new models and apparatuses on display in the museum. This German canon was especially striking in the context of the museum's location in Bavaria. Bavaria remained a notoriously separatist state even after it joined the German Reich in 1871, and its status as a member of the mostly Protestant Reich was not uniformly accepted by Bavarians, especially by the

large population of conservative Catholics. Furthermore, Munich itself was struggling with relevance in the early twentieth century; its status as a cultural center was being rapidly eclipsed by the rising star of cosmopolitan Berlin.

The few modern histories of the Deutsches Museum that exist have usually been written by employees of the museum or close colleagues and are largely institutional histories focusing on the administration of the museum over time. One of the most recent publications is from 2003 and was assembled as a centennial celebration of the museum's founding charter. The one publication that has grappled with the nationalist ideology at play in the Deutsches Museum is the 2010 edited volume *Das Deutsche Museum in der Zeit des Nationalsozialismus*, which argues that it was readily complicit in the Nazi regime, and documents the steps that von Miller and his employees took to make the museum a Nazi-friendly space.[52] Nonetheless, this account is primarily focused on the actions of the museum during the Third Reich, rather than interrogating what ideological positions present at the founding of the museum allowed for it to grow into a space that encouraged and catered to Nazi participation.

In this chapter, I explore how the Deutsches Museum constructed an idea of "German" specifically oriented around technological innovation, and how the planetarium's development was a central part of this project. This happened in opposition to lingering Bavarian separatist sentiments, as well as alongside an effort to revive Munich's cultural relevance. Von Miller explicitly designed the museum around a German

[52] Dorothee Messerschmid-Franzen and Elisabeth Vaupel, ed., *Das Deutsche Museum in der Zeit der Nationalsozialismus* (Göttingen: Wallstand Verlag, 2010); Wilhelm Füßl and Helmuth Tischler, ed., *Geschichte des Deutschen Museums: Akteure, Artefakte, Ausstellungen* (Munich: Prestel Verlag, 2003).

identity that transcended regional differences and could appeal to visitors from all over the Reich and articulated this in the planning of the museum itself, from the "hall of fame" of notable German scientists and engineers that served as the entrance room to the use of manufacturers and suppliers throughout Germany to construct exhibits about German inventions. The design and purchase of the Zeiss company's Ptolemaic planetarium is a central part of this narrative, and the planetarium itself became one of the defining features of von Miller's legacy; von Miller's attempts at developing the planetarium are inextricably connected with his attempts to found the museum. This chapter is divided into three parts: the first covers the early history of von Miller's foundation of the museum in the cultural and political world of turn-of-the-century Munich; the second briefly explores von Miller's national project in the design of the museum itself; finally, the third focuses on the invention of the planetarium and its role in von Miller's grand vision.

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Originally founded as a Benedictine settlement on the western bank of the Isar river in 1158, Munich quickly became a significant city in the dukedom of Bavaria. By the nineteenth century, it was the political center of the Bavarian kingdom, as well as a cultural capital of the region, a reputation supported by efforts from the Bavarian monarchs – notably Ludwig I (1825-1848) and his successor, Maximilian II (1848-1864). The population grew rapidly; in 1801, the estimated population was around 40,000 people, and in 1870, it was around 170,000.[53] By 1903, when von Miller first proposed his museum

[53] *Statistisches Jahrbuch für das Deutsche Reich* (Munich: Kaiserliches Statistisches Amt, 1918).

plan, the population had exceeded 500,000 registered residents, and the city had expanded significantly across the Isar onto the eastern banks.

Throughout this expansion, the kingdom of Bavaria had consistently opposed Prussian imperial expansion. Maximilian II attempted to found an alliance of smaller German states, with Bavaria at the helm, that could directly oppose the aggressive expansion of Prussia as well as Austria.[54] This "third force" alliance would be anchored in Munich, which Maximilian endeavored to make an intellectual center that could surpass the cultural standing of Prussia and Austria. Though his political alliance never came to fruition, Maximilian did succeed in supporting an influx of intellectual and cultural figures with well-funded academic institutions. The Ludwig Maximilian University, which Ludwig I had moved from the provincial city of Landshut to the center of Munich in 1826, continually expanded, outgrowing old buildings and moving into new. Along with this expansion came an influx of royal funds that supported new laboratory spaces and research stipends for scientists. The university's growth was matched by that of the Bavarian Academy of Science, which operated as an institute for advanced independent study, supported by royal funds as well.

Maximilian's efforts to make Munich an intellectual capital above any of the major cities in Prussia were part of a larger effort to resist Prussian expansion. However, when Maximilian died in 1864, he was succeeded by his schizophrenic son Ludwig II, who agreed to sign onto the Northern German Confederation in 1870, after Bavaria had fought alongside Prussia in the Franco-Prussian War. This concession paved the way for a full

[54] Though later, Maximilian would support Austria against Prussia.

integration of Bavaria and the other southern German states into the Prussian-controlled Northern Confederation. Finally, in the aftermath of the war in 1871, Wilhelm I of Prussia was proclaimed emperor of a new German empire. However, Bavaria was allowed to maintain its own railways, post, telegraph service, and military administration, and the royal family also retained local control.[55] Ludwig II died young, at the age of 40, in 1886, and was succeeded by his younger brother, who suffered from more severe mental illness. From 1886 to 1913 Bavaria was ruled by regents – first, by Prince Luitpold until 1912, and then, upon his death, by his son Prince Ludwig. Luitpold carried on the generous support of the arts and sciences begun by his uncle Maximilian, and indeed it was his efforts that sustained the Deutsches Museum through much of its early history, which was marked by continual interruption and failure.

Von Miller was the eldest son of a family with close ties to the Wittelsbachs and to Munich as a city; his father had been appointed as the royal bronze caster in 1875, and had several monuments and landmarks dedicated to him by the early 1900s. Von Miller himself had received the bulk of his engineering training at the Ludwig Maximilian University, and remained in Munich when he began his career in engineering. Before the project of the Deutsches Museum captured his attention, he was already deeply invested in the scientific culture of Munich; in 1882, for example, he organized the first German exposition on

[55] For more on the tension between Bavaria and the rest of the Reich, see Johannes Mattern, *Bavaria and the Reich: The Conflict Over the Law for the Protection of the Republic* (Baltimore: Johns Hopkins Press, 1923); D.R. Dorondo, *Bavaria and German Federalism: Reich to Republic, 1918-1933, 1945-49* (London: St. Martin's Press, 1992); Wilhelm Volkert, *Geschichte Bayerns* (Munich: C.H. Beck Verlag, 2001); Alois Schmid, ed. *Handbuch der bayerischen Geschichte, Band IV: Das Neue Bayern: von 1800 bis zu Gegenwart* (Munich: C.H. Beck, 2003 & 2007).

electrotechnology in Munich, and there he transmitted for the first time an electrical current over a sixty-kilometer distance.[56]

It was in this context that von Miller first proposed his "Museum of Masterpieces of Natural Science and Technology." The idea for the museum came, according to him, after a trip abroad during which he visited both the London Science Museum and the Parisian Musée des Artes et Métiers.[57] Upon his return to Munich he began drawing up plans for a German museum in the same vein. It could be "a site of knowledge, of stimulation and instruction, a site in which youthful enthusiasm can accomplish great things."[58] In early 1903, von Miller brought his proposal to the Bavarian chapter of the Society of German Engineers, who vowed to support his project at the annual meeting of the whole Society, which met in the end of June of that year.[59] On June 28, 1903, the association agreed to donate some 200,000 Marks to the foundation of his "Museum of Masterpieces of Natural Science and Technology." Many of the members of the Society contributed more than a thousand Marks each in addition to funding from the coffers of the Society; Carl von Linde alone contributed 35,000 Marks, and several others contributed 10,000 Marks each.[60]

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[56] Füßl, 62.
[57] Conrad Matschoss, "Einleitung," in *Das Deutsche Museum: Geschichte/Aufgabe/Ziele*, ed. Conrad Matschoss (Berlin: Vereines Deutscher Ingenieure Verlag, 1925), 1.
[58] Ibid.
[59] The Society for German Engineers (*Verein deutscher Ingenieure*) was founded in 1856 in Berlin with 172 members. By 1920, the society boasted more than 23,000 members. During the period when von Miller was proposing his plan, Carl von Linde sat as president. In 1912, von Miller himself took the presidency for two years. Katharina Schmelzer and Diana Fernandez, "Blau, quadratisch, unverwechselbar," *Verein deutscher Ingenieure*, pub. 12 May 2014, https://blog.vdi.de/2014/05/blau-quadratisch-unverwechselbar/.
[60] Wilhelm Füßl, "Gründung und Aufbau 1903-1925," in *Geschichte des Deutschen Museums* (see footnote 51), 76.

Armed with this support, von Miller went in search of additional funding. He received it; by 1906, he had secured one million Marks from the city of Munich, two million from the Bavarian royal family and the imperial government, and an additional four million from "titans of German industry."[61]

The near-immediate outpouring of support, not just from Bavarian sources but from imperial coffers as well, points to the perceived necessity of the museum at this moment. Von Miller's proposal came at a moment when Munich's cultural capital was losing significant ground both to Berlin and to conservative Catholic forces within Bavaria. The first was precipitated by Berlin cultural critic Hans Rosenhagen's incendiary 1901 essays in *Der Tag*, collectively titled "Münchens Niedergang als Kunststadt," in which he offered a scathing critique of Munich's supposedly excellent cultural scene, which he found to be bloated and conservative. Berlin, in his estimation, was the new cultural center. Rosenhagen's essays instigated a dramatic and very public debate about the two cities, and Munich did not emerge unscathed.[62]

Its declining cultural reputation was hastened along by the ongoing conflict between the liberal ruling class, supported by the Catholic royal family but also populated with Franconian Protestants, and the increasingly strong Catholic populists who opposed them. The *Kulturkampf* campaign, the conflict between the imperial German government and the Roman Catholic Church, had largely died out in most of the Reich by around 1880, but it persisted for much longer in Bavaria, where deeply entrenched Catholicism staged a

[61] Carl von Linde, "Geschichte des Deutschen Museums," in *Das Deutsche Museum* (see footnote 53), 13.
[62] See Winfried Leypoldt, "Münchens Niedergang als Kunststadt: Kunsthistorische, kunstpolitische und kunstsoziologische Aspekte der Debatte um 1900," Ph.D. dissertation, Munich University, Munich, 1987.

more pronounced revolt against the *Kulturkampf* policies.[63] The liberal government steadily lost ground to the Catholic Center Party, and by 1912, the conservative Catholics were decisively the victors in the conflict.

The combination of the ascendancy of reactionary politics and the embarrassing decline of cultural relevance left Munich's cultural and political elite in a vulnerable position in the first decades of the twentieth century. It is not, then, surprising that von Miller's 1903 proposal for his museum, which he promised would be a groundbreaking, enormously popular venture, received the immediate outpouring of support that it did. Von Miller was also explicit from the beginning of his venture that he intended the museum to encompass the technological masterpieces of the *entire* German Reich, not just Bavaria. In a 1903 letter to Kaiser Wilhelm II, von Miller lays out the scope of his vision:

> The Society [for German Engineers] has tasked itself with the erection of a *German* [original emphasis] Museum for Masterworks of Science and Technology. In the joyful certainty that everything therein will be dedicated to the honor and the interests of the entire German fatherland, we hope for the promotion of it from Your Majesty […][64]

Wilhelm was delighted, and in a telegrammed reply, conveyed his best wishes and a promise of funds.[65] Von Miller's decision to contact the Kaiser, and his ready assurance that the project would be devoted to the glory of the entire fatherland, rather than Bavaria exclusively, points to von Miller's awareness of the project's significance.

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[63] See, for example, Winfried Becker, "Der Kulturkampf in Preußen und in Bayern: eine vergleichende Betrachtung," in *Der Heilige Stuhl in den internationalen Beziehungen: 1870-1939*, ed. Jörg Zedler (Munich: Herbert Utz Verlag, 2010), 51-91. See also Peter Jelavich, *Munich and Theatrical Modernism: Politics, Playwriting, and Performance, 1890-1914* (Cambridge, MA: Harvard University Press, 1985).
[64] Quoted in "Bayerisch oder Deutsch?" *Kultur und Technik* 2 (no.4, Fall 1978), 14.
[65] Ibid.

However, despite the sudden influx of capital and materials, von Miller still had not secured an adequate home for his growing collection of artifacts. In the fall of 1905 Prince Regent Luitpold offered the use of the old home of the Bavarian National Museum on Maximilianstrasse.[66] The gift of the old National Museum building put von Miller's project squarely in the historic center of the city, making it explicitly part of the storied Munich cultural landscape. Von Miller readily accepted, and began to move his collection into the empty, palatial space. Already, von Miller considered his collection divided into several distinct categories, which would later form the foundation of the permanent museum's organization. Exhibits on transportation technology featured early airship models and an antique steam engine; a chemistry area included a laboratory setup. The astronomy department was particularly well-developed at this early stage, and it appears to be a department to which von Miller devoted an outsized amount of time.[67]

The provisional set-up in the National Museum was popular; in 1907, the space recorded 211,000 visitors, and in 1910, nearly 318,200.[68] However, the National Museum building was better suited to its original collection of small-scale Bavarian folk art and a collection of 18th and early-19th century paintings, and von Miller found it inadequate for

[66] The Bavarian National Museum, also called the *Alte Nationalmuseum*, was founded in 1855 by Maximilian II, the King of Bavaria, as a collection of fine art and Bavarian folk arts and crafts. It was housed in a palace on Maximilianstrasse until 1900, when it moved to a larger location on Prinzregentstrasse. The building sat empty until 1906, when von Miller leased it for the Deutsches Museum's temporary housing. In 1926, after the Kohleninsel location opened, the Maximilianstrasse location became the home of the formerly-royal ethnographic collection, which is now called the Museum of Five Continents. See E.W. Bredt, *München als Kunststadt* (Berlin: Marquart Verlag, 1907).

[67] This is a supposition of my own based simply on the fact that the museum archives have preserved a sizable amount of von Miller's notes and correspondence from the planning era of the museum, and the astronomy wing takes up significantly more paper than any other individual department. This isn't a serious calculation, just an observation based on my time in the archives. This was also substantiated by conversations with Gerhard Hartl, current direction of the planetarium.

[68] Matschoss, 25.

his museum vision. He wanted more than housing for large-scale apparatuses: he wanted space to accommodate a comprehensive account of modern German technology and science, and he wanted a research library that would house a growing collection of technological and scientific texts and serve as a resource for "researchers, students, industrialists, tradesmen, and those working on relevant topics [*Arbeiter von Bedeutung*]."[69]

Even before the National Museum space opened in November 1907, von Miller was actively working to find a better location. In the middle of 1906, several months after Leopold offered the National Museum, the city of Munich offered him Kohleninsel ("Coal Island") in the middle of the Isar river.[70] Kohleninsel, situated near the old city, was largely empty for most of the 19th century, with the exception of a small military barracks on the north end. In the late 1890s, this barracks was absorbed into a neoclassical structure for the 1898 Munich Motor Show. In 1899, the whole structure was destroyed in a devastating flood, and subsequently the island sat empty and largely unused, except by enterprising fishermen and the occasional brave bather. The confirmation of the island as the new location ushered in the next phase of the museum's history, that of its construction.

Von Miller reached an early agreement with the local architect Gabriel von Seidl for the design of the building.[71] Von Seidl was an architecture professor at the Ludwig Maximilian University who specialized in a neoclassical historicist style.[72] His proposed

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[69] Oskar von Miller, quoted in von Linde, 13.
[70] Matschoss, 10.
[71] The city magistrate asked von Miller to announce an open competition for the honor of designing the Kohleninsel building, and von Miller agreed, but it was an open secret that von Seidl had already reached an agreement with von Miller, and very few people actually entered the competition. Matschoss, 12.
[72] Ibid

design covered nearly 11,000 square meters of the southern tip of the island, and was organized into three floors, with a two-story "hall of honors" as a central entrance hall. The entire façade was covered in evenly spaced narrow pilasters that ran all the way up the side of the building, interrupted by narrow windows to the front and wider arched windows along the sides. On the eastern and western corners of the north-facing front of the building were two small observatories, with a main observatory in a tall cupola at the center. In the back south-west corner, a tall square tower featured large-scale weather instruments (a barometer, thermometer, hygrometer, and anemometer) as well as a clock. [*Figures 2.2 and 2.3*] Von Seidl and von Miller intended the construction to be nearly entirely concrete, which at the time was a relatively new material for representational buildings, and made the Deutsches Museum Germany's largest reinforced concrete structure.

The ground of Kohleninsel was broken with great fanfare. Present at the laying of the cornerstone were representatives from the city government and the Prince Regent Luitpold and his son Prince Ludwig. The main guests of honor, however, were the Kaiser himsef, and his wife, who had travelled down from Berlin for the occasion.[73]

Before the groundbreaking ceremony, von Miller announced a change in the name of his museum, from the Museum of Masterpieces of Science and Technology to, simply, the Deutsches Museum. In a reflection on this change in 1925, von Miller wrote:

> The Museum of Masterpieces of Natural Science and Technology, as it was originally called, later took on the name 'German Museum'; not because it was intended to represent the development of the various branches of study and work only through German masterpieces, but rather because through the name should be given the impression that not a particular personality, nor a single city, nor only one state, but rather all the people of the whole

[73] Ibid.

> German Reich have created this temple of glory [*Ruhmestempel*] to German work.[74]

Von Miller located the museum in a much longer history of venerable German institutions: "just as the great cathedrals and the magnificent old town halls were once accomplished by the combined efforts of all the citizens, so too should the Deutsches Museum emerge as such a building, in which all the states and cities, all the corporations and individuals can give [to the project] together."[75] This rhetoric contextualized the museum as a nationally collaborative space, to which "all the people of the whole German Reich" contributed. The museum thus became a space in which the German identity was centered and affirmed.

There was some slight disagreement from his board of directors about the change, largely because another museum already existed (in Nuremberg) with the title "Germanisches Museum," which focused on the history of the Germanic tribes and Germanic culture. Before he announced the name change, von Miller wrote to Luitpold to secure support; the regent's reply makes clear that the stakes of the name change were clear to all involved:

> I, for one, welcome the name. Of course, there are naturally some objections to the fact that it is called *Deutsches* Museum [original emphasis] But that does not matter; the other, which also bears a general German [*deutschen*] name (the Germanisches Museum), is also a general German museum, though it specializes in history. And as everyone already knows what is meant by "Germanisches Museum," so too will everyone soon know what is meant by the "Deutsches Museum."[76]

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[74] Oskar von Miller, "Die Förderer des Deutschen Museums," in *Das Deutsche Museum* (see footnote 57), 357.
[75] Ibid.
[76] Quoted in ibid.

Luitpold here suggests that the projects of the Germanisches Museum and the Deutsches Museum are in some essential way the same – that they both are devoted to the cataloguing and celebration of German heritage, one through history, and the other through science. But the distinction between *Germanisch* and *Deutsch* has a wider significance as well; while *Germanisch* refers to the ancient Germanic tribes that historically populated Germany, *Deutsch* refers to the political and national project of Germany. The "Deutsches Museum" could never be anything but a modern project, with a modern focus.

The contributions of the "whole German Reich" were not simply rhetorical or symbolic. Many of these material contributions came from new inductees to the museum's Member Society, which von Miller founded in 1904. By the end of 1904, the society had 800 members; by 1907, 2250; in 1925, 6000.[77] Von Miller kept careful tabs on the roster of names, and actively recruited both individuals and engineering firms. Many of these firms contributed to the building project. Conrad Matschoss, in his official 1925 account of the founding of the museum, remarks that:

> Not only large funds, but also huge amounts of truly valuable building materials for all the most important interior furnishings came from all parts of Germany, freely shipped on German railways to Munich. Where labor services had to be paid, it became a duty of honor to be satisfied with the lowest possible price. The city of Munich itself has promised free heating and lighting forever![78]

This aid came in the form of visible support as well as material contributions. In the early years of the museum's construction, the site was visited by more members of the Bavarian royal family, as well as dignitaries from Berlin on behalf of the Reich.[79] [*Figure*

[77] Füßl, 74.
[78] Matschoss, 5.
[79] Ibid.

2.4] The repeated visits by both the Bavarian and imperial families afforded the museum an unusually high profile, and were essential parts of von Miller's intention to make it a shining jewel in the rather tarnished crown of Munich. In the face of increasing disdain for Munich, both from artists and cultural critics who saw Berlin as the rising cultural star of the Reich, and from reactionary Catholic forces within Bavaria, whose anti-secular tendencies were also seen by liberal elites as anti-science, the support of the highest local and imperial figures gave the museum a respectable allure.

However, two weeks later, war broke out, and all construction was halted and building materials were rerouted to the war effort. Von Miller occasionally corresponded with Zeiss during this time, but the entire museum project was stalled for four years. In 1919, the Treaty of Versailles ended the war, but the restrictions it placed on Germany destabilized the economy and the ensuing catastrophic inflation meant that von Miller's once extensive resources had very little spending power, and construction remained stalled.

In November 1923, however, the Weimar government introduced a new currency, the Rentenmark, designed to stabilize the economy. This currency reform allowed construction on Kohleninsel to resume, and the building was finished in time for a May 1925 opening. Nonetheless, between 1918 and 1923, the future of the museum seemed bleak. Matschoss gives us a dramatic retelling of this "terrible time":

> [At this time], even strong and faithful personalities began to doubt whether it was still possible to carry out such great cultural undertakings in our poor Fatherland. In von Miller's view, [by contrast], it was more important than ever! If anything can save us, and prepare for our rebirth and ascension, it is profound scientific work in the technical direction. The museum was now facing its greatest challenge yet. Once again, the indomitable will to survive and persevere at any cost was put to the test. […] Fear and worries [must be] banned. Anyone who experienced this [with von Miller] knew that the man behind this great work would also reach the top of this mountain.

> [*Jeder, der diese Sitzung hat erleben können, wußte, der Mann hinter diesem Werk erklimmt auch diesen Berg*.][80]

The terrible time to which Matschoss refers here was not simply the economic instability of the early Weimar years; he was also referencing the dramatic destabilization of Munich, and its pronounced cultural shift. First, April 1919 saw the establishment of a Bavarian Soviet Republic, and the next month saw the brutal crushing of the Republic, largely by the *Freikorps* paramilitary troops. The violent suppression of the Bavarian Soviet Republic eventually made way for an increasingly vocal reactionary conservative presence in Bavaria, which took more radical tones than the pre-war Catholic opposition. In November 1923, this manifested in the unsuccessful Beer Hall Putsch, led by Adolf Hitler, then the leader of the relatively new Nazi Party. By the time of the museum's 1925 opening, Munich had lost much of its remaining cultural caché in favor of a reputation as a far-right backwater.

Matschoss's framing of the museum as a site of renewal, of German rebirth, is echoed in several other contemporary reflections on the role of the museum in the brave new world of post-war Germany. Reflecting on the opening day celebrations, Carl von Linde, for example, remarked that the whole event "awakened an uplifted mood, which wove its spell across Germany, and […] made the museum a matter for the German people [*das deutschen Volkes*]."[81]

The opening celebrations were a sight to behold. They began on 5 May, when, at a conservative estimate, a hundred thousand people lined the streets from Maximilianstrasse

[80] Matschoss, 5.
[81] Linde, 10.

through the center of the old city for a parade. The parade featured elaborately constructed floats imagined as monuments to industry, scientific innovation, and German history. An "electricity" float consisted of an electrical tower conducting bolts of golden lightning to the ground, driven by a man painted gold and flanked by hooded, robed figures carrying lightning bolts and magnets. A float dedicated to machinists featured a nearly full-scale airplane mounted above men covered in soot holding wheels, the symbol of the museum, and drawn by three steam-powered motors, while more men, artfully dusted with soot, strode alongside. [*Figures 2.5 and 2.6*] One float, simply called "The Earth," featured a globe covered in 3D models of various architectural triumphs – sky-scrapers, suspension bridges, etc.

Alongside these floats constructed as homages to German industry and scientific knowledge were others dedicated to German and Bavarian cultural heritage. One particularly enormous float featured a towering papier-mâché head of an 18th century woman drawn by men in blackface on white horses. No archival record survives to explain this display, so it remains unclear whether this was a reference to a specific queen (either of Bavaria or Prussia), or a general homage to the idea of a German queen. At any rate, the attendants in blackface evoke a racist imperialism. Another float in this historical vein was devoted to medieval Bavaria, with maypoles and knights on horseback in armored breastplates.[82] [*Figures 2.7 and 2.8*] These evocations of a historical tradition linked the scientific and technological advancements championed by the Deutsches Museum to a romantic narrative of German, and Bavarian history.

[82] Photographs, Bildstelle: Museumgeschichte 1, Deutsches Museum Archive.

The mixture of floats dedicated to advancements in science and industry, to German history, and to specifically Bavarian history, was deliberate, as was the parade's route itself. It began at the doors of the Museum's temporary home in the former building of the Bavarian National Museum on Maximilianstrasse. Its path, through the center of the old city, brought airplanes, steam engines, and other trappings of modern ingenuity into the oldest corners of the city, past the famous clock atop the town hall at Marienplatz, the medieval Viktualienmarkt, and then venturing west past the central train station, finally coming to a stop at Ferdinand-Millerplatz, named for von Miller's father. [*Figure 2.9*] The parade never ventured in the direction of the new museum building, but instead brought the spirit of the museum firmly into the space of the old city, into Munich's historical legacy.

The actual opening day, 7 May, was filled with performances, speeches, and receptions in the large meeting halls von Seidl had designed in the middle of the building. Gerhart Hauptmann, the playwright who had won a Nobel Prize in 1912, wrote a short pageant that opened the proceedings. The Munich Teachers' choir, the *Lehrergesangverein*, sang, and a sized-down orchestra from the Munich Philharmonic performed excerpts from *Die Ruinen von Athen*, a piece by Beethoven that had been reimagined by Richard Strauss.[83]

At the center of all the celebrations was von Miller, stately and elegant at seventy, a benevolent patriarch celebrating the realization of a project more than twenty years in the making. In a Berlin cartoon published the weekend of the grand opening, von Miller

[83] Opening Ceremony Program, provided to author by Gerhard Hartl, Deutsches Museum.

appears in the guise of a towering monk, arms outstretched to the people who have come to pay him tribute.[84] [*Figure 2.10*] A scholar presents at heavy leather-bound tome while a round-bellied capitalist hoists a heavy radio towards him. A small boy carries a kite while women in medieval frocks bring sacks of gold. Behind him, a warship edges into the frame while horses and military men rush towards him. Above, cherubim laugh with delight as a zeppelin floats overhead. Von Miller's monk costume here is a deliberate reference to the Munich coat of arms, which features a rendition of a Benedictine monk in a gold-trimmed robe, with a book in one hand and the other arm outstretched. Von Miller thus stands in for Munich itself, welcoming in the entirety of German history with open arms, the pre-modern and the modern alike. Even as a gentle joke, the cartoon acknowledges that the scope of von Miller's ambition extended beyond simply cutting-edge machinery and into a much broader, nationally-defined historical interest.

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When visitors entered the museum for the first time, they found themselves first in a soaring, two-story elliptical room in richly paneled wood, with a ceiling mural depicting a classic zodiac celestial chart. Between the two heavy arched doorways, the walls were filled with portraits and busts. This room was called the *Ehrensaal* or Hall of Honors, and was a quite literal expression of von Miller's initial desire for his museum to be a *Ruhmestempel* of German technological ingenuity. In his official description of the room, Walther von Dyck begins with an epigraph from Goethe: "The best monument to Man is Man himself." "We want," von Dyck continues, "to take Goethe's words to heart as we

[84] Photographs, Bildstelle: Museumgeschichte 1, Deutsches Museum Archive.

begin the journey through the museums treasures, beginning with the Hall of Honors."[85] [*Figures 2.11 and 2.12*] The Ehrensaal was also an explicit reference to the Bavarian institution of the Hall of Fame, of which there were two notable examples: the 1853 Ruhmeshalle located in Munich, and Walhalla, the 1842 memorial located in the country outside the Bavarian city of Regensburg.[86]

The members of this room range from titans of scientific and technological discovery to major figures of German history. According to von Dyck, who helped design the room, "the cultural work done by us Germans appears together with that of foreigners – just as we Germans are accustomed to living amongst others, we also include strangers without prejudice, to accept them and acknowledge them."[87] The inclusivity von Dyck implies with this statement is rather less apparent in the members of the hall themselves – there are some foreign names, like Galileo and Copernicus, but the vast majority of the busts and portraits and friezes are dedicated to scientists and engineers from the German-speaking world. From twelfth-century Albertus Magnus, to Guttenberg, Fraunhofer, Gustav Kirchhoff, and Ferdinand Graf von Zeppelin (the inventor of the Zeppelin), more

[85] Walther von Dyck, "Der Ehrensaal des Deutschen Museums," in *Das Deutsche Museum: Geschichte, Aufgabe, Ziele* (see footnote 57), 19.

[86] These halls, inspired largely by the 1791 Pantheon building in Paris, were designed as testaments to those who had contributed to German history and culture. Walhalla, commissioned by King Ludwig I, was a sprawling palace modeled after the Parthenon and set atop a hill, with a central hall filled with sixty busts of significant cultural and political figures of Germany, largely from Bavaria but occasionally including figures like Goethe and Lessing. The Ruhmeshalle, whose construction began at the same time as Walhalla but which was finished a decade later in 1853, was designed for a similar purpose, though it explicitly honored those who had contributed to Bavarian culture, and housed more than a hundred busts.

[87] Von Dyck, 20. Many of the more modern busts honored engineers who had been dead for less than forty years, like Robert Bunsen (d. 1899), Werner von Siemens (d. 1892), and Zeppelin as well, who had recently died in 1917. The inclusion of so many modern engineers could be explained simply by observing that many of them (Siemens and Zeppelin in particular) had been early financial backers of von Miller's project.

than eighty percent of the figures in the room are German, and not all of them are direct contributors to science or technology.

Above the doorway that led into the rest of the museum, a reproduction of the Tischbein portrait of Goethe reclining in the Roman countryside had pride of place. [*Figure 2.13*] While Goethe, of course, made a number of contributions to the study of plant morphology, his presence, as von Von Dyck's epigraph suggests, has more to do with his general status as the patriarch of post-Enlightenment German literature and culture than with his studies of plants. Also hung high above the entryways are reproductions of the official portraits of King Ludwig I of Bavaria and Friedrich the Great. These three figures, framing the entrance into the Hall of Honors, represent yet another explicit articulation of von Miller's inclusive vision of German heritage, that takes both Bavarian specificity and the Reich more broadly into account. It suggests a cohesive narrative of German cultural evolution in which literature and philosophy are joined by technological innovation as an equally important cornerstone. The Ehrensaal is thus a very literal attempt on von Miller's part to actively establish a canon of German technology.

Visitors proceeded through the Goethe doorway into the eastern wing to begin their exploration of the museum. [*Figures 2.14 and 2.15*] The collections were divided into thirty categories, ranging from fields of science (physics, chemistry, geology, and astronomy), to infrastructural and industrial fields (mining, metallurgy, textiles, paper making, beer brewing, and electricity, for example), and apparatuses and machines (shipbuilding, trains, and musical instruments, among others).

The scope of fields was unprecedentedly large, but perhaps the most unusual element of the museum, especially compared to its predecessors, was the number of

immersive and interactive displays. Both the London and Paris museums that originally inspired von Miller, as well as the many natural history museums of the 19th century, tended to be designed around the curio cabinet model. Historians of 18th and 19th century museum culture have argued that in the late 18th century, museums evolved from a basic curio cabinet model, in which objects were oriented by theme, material, and even size, to one in which objects were organized in critical relation to each other. Museums thus began to tell historical narratives with their displays, ascribing meaning to artifacts relative to other artifacts in a progressive chain of development and innovation.[88] This effect can be seen not just in natural history collections, but in art museums from the period as well, which began assembling works into national collections to tell stories of the evolution of Italian painting, for example, or German textile art, over the centuries.

Thus, museums like the London Science Museum and the Paris Musée des Arts et Métiers arranged apparatuses in ways that offered a narrative of technological progress from one invention or discovery to the next. Nonetheless, the objects they displayed were still arranged neatly in rows, available for examination but not interaction; explanation of phenomena stood secondary to displays of the artifacts themselves.

By contrast, the Deutsches Museum included interactive and immersive displays from the very outset. The optical hall, for example, included a balcony on which were permanently mounted several models of historical telescopes, through which visitors could look at the sprawling landscape of Munich across the eastern bank of the Isar. The musical

[88] See, for example: Eileen Hooper-Greenville, *Museums and the Shaping of Knowledge* (London: Routledge, 1992); Karen Rader and Victoria Cain, "From natural history to science: Display and transformation of American museums of science and nature," in *Museums and Society* 6 (2, Jul 2008), 152-71; Steven Conn, *Museums and American Intellectual Life, 1876-1926* (Chicago: University of Chicago Press, 1998).

instrument department had a display that demonstrated the principals of wind instruments by letting visitors blow across various orifices of varying depth. [*Figure 2.16*]

The effect of the interactive and immersive displays was to make the museum a collaborative space, in which visitors made meaning out of the devices and installations presented to them. In *Archaeology of Knowledge*, Foucault writes that the transformation of knowledge organization in the 19th century produced "an area made up of organic structures, that is of internal relations between elements whose totality forms a function."[89] The idea of an organic whole is present in the founding document of the museum, in which von Miller wrote:

> The museum is comprised not only of the collection of historical and contemporary works of research and invention in the scientific and technical fields; it also functions as a living organism made up of all of its parts and members, who are all participants in a communal purpose and activity – be it for the collection of objects themselves, or for other scientific work – that unites them all together.[90]

Many of the rooms in the museum were converted into fully immersive reproductive spaces, such as the trio of chemistry rooms that showed visitors the evolution of laboratory design from a 16th-century alchemist's chambers to an advanced 19th-century chemistry lab. [*Figures 2.17, and 2.18*]

In his essay on the "Educational Task" [*Bildungsaufgabe*] of the museum, Georg Kerschensteiner suggests another purpose of the immersive displays:

> If the basis of all education is awe [*Ehrfurcht*] – awe in the face of truth, of morality, of beauty, etc., -- and if, as I have said before, awe is nothing other than the reverent worship of something sublime [*Erhabenen*], that with

[89] Quoted in Hooper-Greenhill, 218.
[90] Quoted in Matschoss, 6.

> overwhelming size and strength affects our smallness, real or perceived, then the museum must as an educational institution do everything in its power to arouse this feeling of awe by way of its organizational method.[91]

Kerschensteiner argues that awe can only be inspired in those who recognize the labor and effort involved in the production of whatever work is in question, because "the Heroic lies not in the achievement [*Leistung*] or the success [*Erfolge*] [of a task,] but in the struggle [*Ringen*] for the achievement, and the resistance to the suffering of this struggle."[92] In other words, the work must be legible as a success of labor and effort in order to inspire the awe that is necessary for proper education.

According to Kerschensteiner, the legibility of an apparatus or concept comes not just from a physical understanding of how it works, but also an understanding of its evolution. The museum thus ought to give historical context to its collections as well. This attention to historical narrative is especially apparent in the astronomy section, the largest and most remarkable of all the museum's departments, and the department that housed the most famous of the museum's apparatuses: the planetarium.

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The astronomy department was literally the centerpiece of the museum structure, occupying two floors directly above the Ehrensaal and extending slightly back. The fourth floor space was further divided into two half floors, and its ceiling was raised about two meters higher. The department's territory extended on the four floor down narrow hallways to the west and east, with small observatories on each end. [*Figures 2.19 and 2.20*]

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[91] Georg Kerschensteiner, "Die Bildungsaufgabe des Deutschen Museums," in *Das Deutsche Museum* (see footnote 57), 41.
[92] Ibid, 41.

Unlike the departments housed in the two main floors of the museum, in which visitors flowed from room to room on the same level, the astronomy department was vertically organized, so that visitors could enter only on the third floor and proceed upwards to the observatories. Visitors first encounter a hallway with a small exhibit dedicated to the historical relationship between astrology and astronomy, and then would enter a room devoted to explaining the geocentric Ptolemaic worldview. A flight of stairs at the back of the Ptolemaic room led to the second level, which taught them the principles of the Copernical heliocentric system. A final flight of stairs took them to a room devoted to the tools of astronomical practice – telescopes, astrolabes, even a to-scale reproduction of Tycho Brahe's observatory. From there, they could move down the west hallway, lined with an exhibit about geodetics, to the Carl Zeiss forty-inch refractor telescope in its small dome; or down the east hallway, past an exhibit on cartography and stellar navigation, to the Goertz forty-centimeter reflector. When they exhausted these, they could return to the central column of exhibits and proceed up the final flight of stairs, where they would enter the cupola and see the large 1839 fifteen-inch Fraunhofer refractor telescope that von Miller purchased from the Pulkova Observatory (the official observatory of the Russian Academy of Sciences).

This organization was intentional; as visitors moved upwards through the exhibit, they encountered increasingly complex astronomical concepts and theories, until, at the very top, they reached the observatories, which were regularly open on late afternoons for observations of the moon, Mercury, and Venus.

The astronomy department was one of the first departments von Miller designed and for which he began collecting. By the time the museum opened in its provisional

National Museum location in 1907, von Miller had already amassed an impressive number of instruments. Early items in his collection included a Fraunhofer refractor and several antique astrolabes, but the stars of this division were unquestionably the two large glass globes built by Michael Sendtner, a maker of precision measurement instruments in Munich.[93] Von Miller sent an inquiry to Sendtner in 1905, suggesting that he considered the project that he intended Sendtner to make an essential part of his new venture.[94]

What von Miller asked Sendtner to construct were two large models of the solar system, one that would display the heliocentric Copernican system, and one that would demonstrate the geocentric Ptolemaic. Sendtner had never built an apparatus of this type before, but mechanical solar system models, often called orreries, were a well-known scientific device.[95] Famous earlier examples included the unusual Eise Eisinga Orrery, which Eisinga constructed on the ceiling of his parlor in the Netherlands in 1781; the Rittenhouse Orrery, a tabletop orrery and clock combination that David Rittenhouse constructed in 1767 in Philadelphia; and the Russell Orrery, also called the Columbian Orrery, which was for most of the 19th century considered the largest orrery in the world, and which toured across the eastern coast of the United States before being permanently housed at Wesleyan University in Connecticut.[96] [*Figure 2.21*] Orreries, even those as large

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[93] King, 341.
[94] Ibid.
[95] The name "orrery" comes from Charles Boyle, the fourth Earl of Orrery, who commissioned such a model from John Rowley, a London instrument maker. Rowley himself worked off the model of George Graham, who had built the first modern orrery in 1704 with his clockmaker partner Thomas Tampion. Typically, "orrery" refers to geared solar system models and can refer both generally to these models as well as specifically to models that only display the sun-earth system.
[96] For a general overview of these and other orreries, see Henry C. King, *Geared to the Stars: The Evolution of Planetariums, Orreries, and Astronomical Clocks* (Toronto: University of Toronto Press, 1978). The glass-blown planets of the Russell Orrery have recently all been reunited after nearly a century of separation by Roy Kilgard of the Wesleyan University astronomy department (with minor assistance from the author!).

as the 11-foot-diameter Russell Orrery, were typically table-top constructions, with a crank on the side of the table surface which controlled the rotations of the all the planets (and moons, if detailed enough). The viewer thus looks down on the motions of the planets from above.

The Sendtner orreries are particularly remarkable for their housing; rather than building the typical table-top construction, Sendtner mounted the delicate geared systems in 1.5m -diameter glass globes, which themselves rested on wooden stands. [*Figures 2.22 and 2.23*] On the surface of the globes, he painted precise locations of the constellations, and provided lines for the equator and ecliptic. The planets were mounted on curved arms supported by flexible cables, and in the Copernican model, the gilt sun rotates as the planets move in perfectly circular orbits around it (all planets except for Earth and Saturn also rotate). In the Ptolemaic model, the earth rotates at the center, and the inner planets all also display epicyclic movement.

Though not by any means the largest orreries ever constructed, they were celebrated for the delicacy of their construction even at their large scale, and in the following decade, Sendtner regularly fulfilled requests for versions of the globes to be housed in museums abroad, such as the Royal Scottish Museum in Edinburgh and the Franklin Institute in Philadelphia.[97] Despite the popularity of the globes, von Miller still found them insufficient for his plans; in particular, he felt that the top-down perspective forced by the orrery

[97] King, 342. In 1929, for example, Max Adler, the founder of the Adler Planetarium in Chicago, wrote to von Miller about the globes. At the time, Adler was working on the interior design of the Adler Planetarium (which would open in 1930 as the first planetarium in the United States), and he felt that the globes would be an essential part of the Adler's historical astronomy display, which he intentionally modelled after the Deutsches Museum. Sendtner had given Adler a quote of 9700 Marks for both globes, but Adler felt this was excessive, and asked von Miller if he might have access to a discount. Max Adler to Oskar von Miller, 26 March 1929, Bestell-Nr 1119/3, Max Adler Correspondence, Deutsches Museum Archives.

structure failed to fully engage the viewer.[98] He embarked on a search for larger-scale planetary devices, but while the museum was still based in the National Museum space, his search remained fruitless.

As construction on the new Kohleninsel location progressed, von Miller renewed his search for large scale planetary displays. When Sendtner told him it would be unfeasible to construct larger glass globes than those he had already built, von Miller asked if Sendtner might instead be able to use the same construction from his orreries on a ceiling-mounted apparatus, a modern version of the Eise Eisinga orrery in the Netherlands. Sendtner provided a sketch of what such a system would look like, but felt such an undertaking was too large for his interests, which lay towards precision instruments.[99] [*Figure 2.24*] Von Miller then put out a call for design entries from interested parties who thought they could construct a large-scale planetary model that would accurately depict the planetary motions of the Copernican heliocentric system. The entries he received varied dramatically. A Professor Schoubye, recently retired from the Prussian Military Academy in Lichterfeld, for example, proposed a transparent, rotatable star map, instead of a geared orrery. However, he refused to produce a schematic for von Miller without advanced compensation, since he found himself in need of cash after "breaking the habit of *travailler pour le roi de Prusse*."[100] Von Miller declined.

Another entry into the contest came from an economist in Nuremberg who sent von Miller a copy of his patent-pending design for a device that simultaneously displayed both

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[98] Franz Fuchs, *Der Aufbau der Astronomie im Deutschen Museum (1905-1925)* (Munich: Deutscher Ingenieur-Verlag, 1955), 54.
[99] Fuchs, 54.
[100] Fuchs, 55.

the heliocentric and geocentric systems, and who promised von Miller the rights to the design if von Miller could send him a "parallactic telescope" in return.[101] Von Miller, again, declined.

Finally, in early December 1912, von Miller received a letter from a Professor Sickenberger, from Bad Abling, who wrote that, "the news that the Deutsches Museum is planning to install a large planetarium interests me greatly, as I myself have become intensely preoccupied with such machines. […] Since I consider this a matter of public honor in the name of the Fatherland, I humbly beg permission to submit my contribution."[102] Sickenberger's framing of his offering as a matter of national pride is telling, especially considering von Miller had only very recently changed the name of the museum to reflect his interest in building a specifically German collection of technology.

Von Miller quickly wrote back asking for more details, and Sickenberger replied with twenty-five tightly handwritten pages outlining his corrections. In Sendtner's original plan, not only the planets rotated from the central axis; an entire dome painted with fixed stars was also suspended around the apparatus, allowing visitors to stand underneath and see the motions of the planets against a celestial backdrop. What Sickenberger suggested instead was a model in which the planets moved on several different tracks, while the fixed stars were painted in a panoramic wrap around the device. This allowed it to be built even bigger than Sendtner's original design and incorporated the entire structure of the room into the experience.[103]

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[101] Ibid.
[102] Ibid.
[103] Ibid.

Von Miller enthusiastically adopted Sickenberger's suggestions and by February 1913 had completed a plan for an apparatus in which planets hung from rails in the ceiling at relatively to-scale positions from the sun (with the exception of Saturn and Jupiter, whose orbits were shrunk to accommodate the space), and rotated in slight elliptical orbits. [*Figure 2.25*] The sun hung in the center of the orbits and contained an electric lamp which illuminated the faces of the glass-blown planets. The room, following Sickenberger's suggestion, was a cylindrical chamber twelve meters in diameter and 2.8 meters high; 180 glowing stars studded the wall (an effect created by electric lamps of relative brightness behind small holes in the wall), and the twelve zodiac constellations were painted in gold.[104]

The most distinctive feature of the room was the viewing platform mounted on a rail in the floor that perfectly matched the Earth rail in the ceiling. One visitor at a time could stand on the platform and look through a wide-angle periscope lens. As the track rotated (at a speed of one full rotation every twelve minutes), the sun would remain in the center of the visitor's vision, while the planets would appear to move in and out of view, and occasionally move backwards in retrograde. The planetarium thus demonstrated how the apparent epicyclic motion of the planets was actually caused by the relative position of the earth and the sun.

With a plan in hand, von Miller had to find a manufacturer who could build it. He sent inquiries to Sendtner, even though he had already declined, as well as to several other Bavarian instrument makers, but von Miller found none willing to undertake what he

[104] Ibid.

described as an "enormous and entirely novel installation."[105] When he could find no local manufacturers, he sent a missive to an optical instrument manufacturer in the small Thuringian town of Jena. Unfortunately for von Miller, even Carl Zeiss declined and returned the detailed sketches von Miller had included in his request, writing that "we cannot deal with the production of the planetarium, as such work does not fall at all in the scope of our manufacturing."[106]

Despite finding no manufacturer willing to try to reproduce the Copernican Planetarium, von Miller continued to devote time to refining the design. The idea for the moving viewing platform below the earth appears to have been at least partly inspired by a small device in which von Miller had recently taken an interest. The Orbitoskop, invented by a secondary-school teacher in Basel named Eduard Hindermann, was a small table-top device meant to demonstrate the cause of apparent retrograde motion of planets. [*Figure 2.26*] Two l-shaped arms extend from a central gear shaft; at the end of one arm, representing the earth, is a bright electric bulb, and at the end of the other is a small sphere representing another planet (adjustable to demonstrate Mars, Venus, or Mercury). A larger globe representing the sun is hung from the ceiling directly above the central shaft, and the entire device is surrounded by a cylindrical screen. In a darkened room, the light from the earth casts shadows of the sun and the second planet onto the screen; when the gear is turned by hand crank, the whole apparatus rotates, and while the sun tracks a straight line across the screen, the other planet will exhibit retrograde motion, which is made clearly

[105] Ibid.
[106] Letter from Carl Zeiss Jena to von Miller, 30 July 1913, Verwaltungsarchiv, Deutsches Museum Archives

visible by the shadow on the screen. Hindermann intended the device to be used in classrooms and sold several of them for one hundred Swiss francs a piece.[107]

Hearing that von Miller was looking for planetarium designs, Hindermann sent a description of the device with a photograph of it in use, along with a note that, "of course, the idea of projection by means of light can also be used with advantage for [the planetarium system], which we would be happy to discuss with you."[108] Von Miller seized on the idea and invited Hindermann to bring the apparatus to the museum for a demonstration. Von Miller never purchased the device for the museum (in fact, the only extant model is in the small collection of Astronomisches Büro in Vienna), so it remains unclear to what extent the Orbitoskop influenced the design of the planetaria von Miller was developing, but his enthusiasm for it is another example of the zeal with which he approached the planetarium question.

In his account of the early history of the Deutsches Museum, Franz Fuchs (von Miller's longtime second-in-command, who oversaw the Astronomy, Physics, Mathematics, and Musical Instruments departments of the museum) notes that von Miller thought the design of the Orbitoskop might be useful not just for the Copernican planetarium design, but also for the Ptolemaic model he was concurrently developing.[109]

Von Miller always envisioned the Copernican planetarium as part of a duo of large scale planetary devices. Concurrently with his extensive efforts to design and manufacture the Copernican model, he was also soliciting designs for a Ptolemaic model in the same

[107] King, 342.
[108] Quoted in Fuchs, 58.
[109] Ibid.

vein. He struck up a correspondence with Max Wolf, a professor in Heidelberg and the former director of the Baden Observatory, who proposed a large hollow, 7m-diameter sphere lined with electric stars, which would rotate around a raised platform representing a fixed Earth position, in which a viewer could stand and look up at the stars orbiting around them. [*Figures 2.27 and 2.28*]

In a curious twist, a nearly identical prototype was under construction at the same time in Chicago. Designed by Wallace Atwood for the Chicago Academy of Sciences, the Atwood Sphere was a 4.57m-diameter wooden globe that rotated around a raised stationary platform. [*Figure 2.29*] The stars of the sphere were created simply by holes of various sizes drilled into the thin panels of sheet iron that made up the surface of the globe. Outside light came through the holes, producing the illusion of stars without a cumbersome electrical set up. The entire apparatus was rotated by an electric motor. Neither Atwood nor Wolf had any idea of the others' design, but both were clearly influenced by a much older tradition of rotating globes, stretching back to the Gottorp Globe of the 1650s.[110]

The most significant distinction between Wolf's model and the Atwood Sphere was that Wolf's stars were produced by 180 individual electric bulbs, compared to the Atwood's simple hole-punching technique. Electricity gave greater control over the brightness of stars, but it also allowed for a more complex demonstration of planetary and solar motion. After a conversation with Sendtner, Wolf added a simplified geared structure within the dome to demonstrate planetary and solar motion.[111]

[110] King, 342.
[111] Fuchs, 62.

A public announcement of von Miller's intentions to install the two large planetaria appeared in the miscellany page of the *Deutsche Uhrmacher-Zeitung*, the premier source of German clock-making news. In it, we find mention of both the Copernican planetarium and a "spherical structure" that will feature a demonstration of the Ptolemaic system. Both machines, the notice promises, will be ready in early 1915.[112]

However, the complexity of the electrical system proposed meant that von Miller once again could not find a manufacturer willing to undertake the task. In October 1913, von Miller sent both an updated sketch of the Copernican Planetarium as well as new sketches of Wolf's Ptolemaic design back to the Zeiss company. This time, Zeiss's objection was not only to the mechanical difficulty of the request, but also to von Miller's overall museum organization and design. Von Miller's plan was to install the planetaria in two different locations: one would be directly above the "hall of honors" to the front of the building, and the second directly below the main observatory. Franz Meyer, an engineer writing on behalf of Zeiss, found that "the two planetaria are nowhere near each other, and the public's impression of one will be obliterated [*verwischen*] by the time it takes them to get to the next."[113] This prompted a furious discussion between von Seidl and von Miller, the latter of whom wanted to redesign the central section of the building to better accommodate the needs of the two planetaria, and the former of whom expressed frustration that "the aesthetic vision was being sacrificed for practical needs."[114]

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[112] "Vermischtes," *Deutsche Uhrmacher-Zeitung* 36 (14), 15 July 1912, 237.
[113] Fuchs, 60.
[114] Quoted in Fuchs, 60.

The issue remained unresolved for several months, with von Miller's inquiries to Zeiss going unanswered, until early 1914, when Franz Meyer, on behalf of Zeiss, wrote von Miller that Zeiss had reconsidered his requests and thought it might now be possible to construct, if not the entire apparatus of either device, some of the electric parts.[115] In April von Miller traveled to Jena with his assistant Fuchs to discuss the project in person, with Meyer, Rudolf Strauber (Zeiss' scientific director and an advisor on the board of the Deutsches Museum), and the engineer Walter Bauersfeld of the astronomy department at Zeiss.[116]

The main topic of discussion was the logistical challenges of Wolf's original design. It was Bauersfeld who first suggested that instead of using a modified orrery structure to make the sun and planet motions visible, they might construct a modified projection apparatus that could shine the sun and planets along the ecliptic without the cumbersome structure of arms. Almost immediately, Bauersfeld expanded on the idea. As he later recalled, he blurted out, "and why not also the fixed stars?"[117]

The proposal to project everything from a central optical device rather than mount every individual star on the surface of the dome allowed for a dramatic redesign of the entire structure. Previously, Wolf and Sendtner's model was constrained by the wiring necessary for hundreds of individual bulbs, as well as the rotational apparatus that would turn the entire dome while the audience stood inside on a fixed platform. With all the optics constrained to a projector, which Bauersfeld envisioned as a small sphere mounted on a

[115] Meyer correspondence, courtesy of Gerhard Hartl, Deutsches Museum Archives.
[116] Ibid.
[117] Walter Bauersfeld, untitled essay, *Zeiss-Werkzeitung* 28 (1957), 87.

reflective concave dish on a two-meter high stand in the middle of the room, the room no longer had to rotate. [*Figure 2.30*] Instead, he suggested a stationary hemispherical dome about nine meters in diameter.[118] In early July, Bauersfeld produced architectural sketches for the Deutsches Museum planning board, and all hoped the manufacture would be completed in time for the 1915 opening of the museum.[119]

Though Zeiss officially had abandoned the project during wartime, correspondence suggests that von Miller was still in contact with several of the Zeiss engineers, most notably Bauersfeld, though they made no official changes to the design.[120] In July 1918, Zeiss sent a missive to von Miller announcing that they were renewing their interest in the project.[121] In March 1919, the endeavor began in earnest once more, and Bauersfeld devoted himself to designing a dome and projector combination that would allow all stars and celestial objects to appear in proportion.

Around 1921, Bauersfeld redesigned the projector apparatus.[122] Instead of the spherical projector mounted on a stand, he instead suggested a spherical projector connected to a cylinder of smaller projectors stacked on top of each other; the entire apparatus was mounted at an angle onto a strong brace. [*Figure 2.31*] The sphere was studded with 31 miniature projectors, all of which together could display 4500 stars. Eleven additional projectors at the base of the sphere produced an image of the Milky Way, and

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[118] Sketches, July 1914, courtesy of Gerhard Hartl, Deutsches Museum Archives.
[119] In February 1917, a short article describing the plans for both the Copernican and Ptolemaic planetaria was published in a small brochure from the Stuttgart-based scientific press Kosmos Verlag; in this description, the Ptolemaic planetarium still basically looked like Bauersfeld's pre-war proposal of a spherical projector. Courtesy Gerhard Hartl, Deutsches Museum Archives.
[120] Fuchs, 60.
[121] Zeiss's history during this time, and their decision to undertake the planetarium project, will be covered more comprehensibly in Chapter 2.
[122] Fuchs, 61.

an additional thirty projected labels and outlines of constellations (both the Milky Way and constellation projectors could be switched off). In the cylindrical extension, nine separate projectors, each with their own gear shaft, projected celestial bodies – two for the sun, two for the moon (with the capacity to show different lunar phases), and five additional ones belonging to planets (Mercury, Venus, Mars, Jupiter, and Saturn). The whole projector originally required one 200 watt bulb (a special bulb designed by Zeiss and called the Nitralamp), though later this was replaced by a 500 watt bulb for more brightness.[123]

Von Miller was thrilled by the pace at which the project was proceeding and wrote to Bauersfeld that word of the planetarium had aroused the "greatest interest among learned men and lay people alike," and that he expected it to be the most popular attraction of the new museum.[124] Bauersfeld authorized the first test run of the projector in July 1923, though it took several months of calibration to produce the correct clarity and focus. In September he wrote excitedly to von Miller to let him know that the projector was fully operational. Von Miller rushed out the following day to see for himself.

Finally, in March 1925, after several more years devoted to refining the machine and perfecting the dome construction, the Mark I planetarium was shipped to Munich and installed in the dome (the Copernican planetarium had been installed a floor above in November 1924). [*Figure 2.32*] The final space was a nine meter-diameter hemisphere supported on a 1.5 meter-tall cylindrical wall, so that the horizon line was several heads above visitors when they sat down in the chairs. The projector itself was mounted in the middle of the room with a control station to the back in the north quadrant of the circular

[123] Ludwig Meier, *Der Himmel auf Erden: Die Welt der Planetarien* (Leipzig: Barth Verlag, 1992).
[124] Letter from von Miller to Zeiss, 30 Sept 1921, Verwaltungsarchiv, Deutsches Museum Archive.

space. In April, a small silhouette of the Munich skyline was mounted along the horizon as a way to orient the audience and also give them a sense of situatedness. [*Figures 2.33 and 2.34*]

When the museum opened on 7 May, the planetarium had its first official performance, with a lecture given by Fuchs.[125] He began by showing the sky as it would appear above Munich at nine o'clock that evening, pointing out the recognizable late spring constellations. As the visitors became accustomed to the light, Fuchs slowly began running the planetarium through its paces. As the machine began slowly rotating, showing the stars rising and setting, he illuminated the sun projectors in the lower cylinder and demonstrated several days' worth of sunrises and sunsets. Fuchs then accelerated the motor, and as days and months went by, used a small flashlight in the shape of an arrow to show how the turn of the earth affected the position of the sun and moon. As the second year began, he started to introduce the moon and planets, all moving around the ecliptic, and with Mars, Venus, and Mercury exhibiting visible retrograde motion. Throughout his lecture, Fuchs slowly increased the speed of the motor, until at the end, it was moving at its fastest pace of a single day in merely two minutes.

The planetaria, and especially the Ptolemaic planetarium, quickly became the most popular attractions of the museum, and the focal point for much of the contemporary press on the museum's achievements. According to visitor records, from May 1925 to March 1928, eighty percent of the 2.2 million visitors to the museum came through the

[125] Script of lecture courtesy of Gerhard Hartl, Deutsches Museum.

planetaria.[126] Dozens of articles appeared in the first few months of the museum's opening, from newspapers as far away as Chicago and New York, inspiring a slew of inquiries about the possible purchase of such a device. The Carl Zeiss Company quickly developed an updated model of the projector, a topic that will be explored in more depth in the following chapter.

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Von Miller conceived of the Deutsches Museum as a paean to a pan-Germanic march of technological innovation and prowess. The planetarium played a key role in this and serves as a case study for understanding von Miller's guiding principles in the foundation of the museum, as well as setting the stage for how it would be subsequently adapted in Jena and Berlin.

The underlying motivations for the inception of the Bavarian Museum lie in a national rather than provincial perspective. Von Miller conceived of his idea at a moment in which Munich's cultural prominence was called into question by outside critics, and in which its liberal political tradition was being eroded by increasingly conservative forces from within. Von Miller deliberately positioned the Deutsches Museum as an unofficial national project, and thus presented the museum to anxious Bavarian and imperial figures as a chance to reignite Munich's cultural star, and to stand as a bulwark against a perceived anti-science sentiment from the Catholic right.

[126] "Abschrifft: Besücherziffern de Deutschen Museums," 20 June 1933, Verwaltungsarchiv 1120/3, Deutsches Museum Archives

In the late 1920s, the physicist Werner Heisenberg (of the Heisenberg Uncertainty Principle) reflected on the role of the Deutsches Museum in the collective Munich sense of self:

> Perhaps one might say with some justification that the city of Munich has endeavored more than any other industrial city in the world to extract from its technical side its human one, the one which is concerned with Art. The enduring expression of this particularly Munich way of believing in progress can be found in the Deutsches Museum. It intervenes in this very deliberate separation of our time, between man and the technology he has created. And *that* is why the answer, or at least the attempt to answer, is deeply connected to the spirit of this *Kunststadt* on the Isar.[127]

Heisenberg here sees the museum as a prime example of what he believes is Munich's enduring status as a *Kunststadt*, directly contradicting those who found it in decline. What makes the Deustches Museum so successful, in his estimation, is a new way of bridging the gap between science and art, in a way no other city would be able to achieve. Heisenberg's praise for the museum was precisely the kind of reaction von Miller was hoping for; a celebration not just of the museum but of its Munich location. Munich in this view is a cosmopolitan force that is an essential part of the Reich.

Von Miller attributed his reasons for changing the museum's name from the original "Museum of Masterpieces of Natural Science and Technology" to the Deutsches Museum to an explicit rejection of a narrowly focused regional or individualistic project and instead as promoted it as a "temple of glory" [*Ruhmestempel*] to German work in which all the people of the German Reich had a stake. [128] The trio of Goethe, Ludwig I and Friedrich the Great in the Hall of Honors provided a permanent and prominent visual

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[127] Quoted in Füßl, 17.
[128] Oskar von Miller, "Die Förderer des Deutschen Museums," in *Das Deutsche Museum* (see footnote 57), 357.

articulation of this goal, one in which the technological progress celebrated by the museum was linked to a larger German cultural evolution.

Not only was the inclusion of the planetarium in this kind of project a logical fit as it served to present a culmination of astronomical knowledge, but its development and innovation in the face of significant technological challenges mirrored the museum's stated focus on both the labor inherent in technological advancement, as well as the achievement thereof. By offering its visitors a window into the work involved in technology, the museum would inspire a feeling of awe (*Ehrfurcht*)—the groundwork for any attempt at education per Kerschensteiner.

This deliberate engagement with the public—from an accessible research library to interactive displays—marked the Deutches Museum as a potent culture force. The carnival-like pageantry of the opening day celebrations that sprawled throughout Munich and the 2.2 million visitors over the museum's first three years attest to its reach. The central location of the planetarium directly above the Ehrensaal reveals its key role, as does the fascinated response of the press to the new device. In what follows, I consider how the planetarium evolved beyond the Deutsches Museum, into a recognizable and well-loved landmark of the interwar period.

Chapter II: The Wonder of Jena
The Carl Zeiss Company and Jena's Cultural Legacy

In December 1926, a German schoolteacher named Bodo Grützner, from the small Thuringian town of Schwarza, wrote to the Carl Zeiss company headquarters in Jena to lodge a complaint in verse. He was writing to rail against the Zeiss-Planetarium in the Prinzessinnengarten in Jena, which had been open since July and which he had recently visited. In an extensive and clumsily rhymed poem, he lays out his central concerns: at issue here is not the planetarium itself, which he says is a "Wunderbau," a marvelous structure, whose artificial sky is full of "secret, warm vitality, just as the Creator meant for us to see it."[129] Rather, his ire is directed entirely towards the name "Planetarium," which, derived as it is from the Latin, is unworthy of the "German spirit" that built it:

Ich hab' geschaut den Wunderbau
Der uns der Sterne Rätsel löst!
Wie einfach, groß is der Gedanke,
Den Sternenhimmel nachzubilden,
Und nicht in Farbe, tot und starr!
Nein, voll geheimen, warmen Lebens,
So, wie der Schöpfer ihn vor unser Auge hingestellt.

I saw the *Wunderbau*
That has solved for us the riddle of the stars!
How simple, how tremendous is the notion
To reproduce to the starry heavens,
And not in paints, lifeless and stiff!
No, full of secret, warm vitality,
Just as the Creator meant for us to see it.

Daß deutscher Geist die Tat geschafft
Sollt jeden Deutschen wohl mit Stolz erfüllen
Und ihm den Glauben geben und die Kraft
Zu hoffen, daß Deutschland wird nie untergehn
So lang' die Sterne ziehen ihre Bahn
Und deutscher Geist lebendig schafft!

That the German spirit accomplished such a feat
Should fill every German up with pride
And give him faith and strength
To hope that Germany will never perish
So long as the stars trace their course
And the German spirit stays alive!

[129] "Zeiss-Planetarium?" *Zeiss-Werkzeitung* 2, no. 1 (December 1926), 10. My translation, with German alongside so that the reader can appreciate the original rhyming scheme.

Drum eins mir nicht gefällt am Ganzen.	So I just don't like this a bit.
Das ist der Name "Planetarium!"	That is, the name "Planetarium"!
Ist unsre Muttersprache denn so arm,	Is our mother tongue so poor
Daß wir auch hier bei Fremden leihen müssen?	That we must borrow from strangers?
Wenn Namen auch nur Worte sind	If names are mere words
Und Schall und Rauch,	And sound and smoke,
So spricht's doch stärker zu den Herzen,	Then it speaks more deeply to the heart
Wenn deutsch wir nennen unser Können	To name our skills in german
Und deutsche Laute künden deutsche Kraft!	And german lutes can herald german strength!
Auf Sterne bau!	Build on stars!
Den Sternen trau!	Trust the stars!
Nach Sternen schau!	Look to the stars!
So nennt doch diesen Wunderbau	So therefore now name this *Wunderbau*
Nun einfach deutsch "Die Sternenschau!"	Simply the german "Sternenschau"!

Grützner's suggested replacement is a distinctly German compound word — *Sterne*, stars, and *-schau*, from the verb *schauen*, "to behold." The company newsletter, the *Zeiss-Werkzeitung*, published the poem along with a response from Walter Villiger, the chief engineer of the planetarium. "It's a good suggestion," he wrote, "and we can certainly use 'Sternenschau' amongst ourselves here. But the work is now known around the world as a Zeiss-Planetarium, and we therefore can no longer change it."[130]

Grützner was neither the first nor the last to make this objection to the name, though he was the only one to do it in rhyme, and this exchange highlights the challenge facing the Zeiss company as they looked to expand the market for planetaria beyond the Deutsches Museum and Jena itself. On the one hand, Zeiss saw the planetarium as an opportunity to create a significant company presence abroad, while recognizing that the international reputation of German technology and engineering after the war was, at best, tarnished, and

[130] Ibid.

production resources were limited. On the other hand, Zeiss recognized that the appeal of and excitement for the planetarium at home stemmed in no small part from its uniquely German origins. Zeiss thus embarked on a two-pronged approach to promoting its planetaria, which relied both on a sustained international press campaign, and the development of the Zeiss company's flagship planetarium in Jena as a destination for diplomatic and recreational visitors alike. This endeavor was carried out in the shadow of Jena's cultural legacy as the late-eighteenth century capital of German idealism and early romanticism, and Zeiss relied on the planetarium as a way to connect itself to this glorious intellectual past, and to situate itself as the inheritor of this cultural tradition. In this chapter, I trace first the development of the Jena planetarium, and its role in Zeiss's dominance of Jena; then, I consider an architectural debate that surrounded the Jena planetarium, and involved several members of the nascent Bauhaus architectural school. I conclude with an exploration of Zeiss's international propaganda campaign. The Jena planetarium thus emerges as both a flagship for Zeiss engineering, and as a cultural touchstone for an intellectual and aesthetic legacy tracing back to Jena's romantic past.

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Jena has always been a provincial town. It sits on the banks of the Saale river in Thuringia, nestled between mountains to the north and southeast, and the expansive Thuringian forest to the west. [*Figure 3.1*] The city is dominated by its two major intellectual legacies: late-eighteenth century German thought and literature, and scientific innovation from the mid-nineteenth century to the present. Jena rose to prominence as a university town with the founding of the Ducal Saxon University (*Herzoglich Sächsisiche Gesamtuniversität*, renamed to the Thuringian State University in 1921, and the Friedrich

Schiller University in 1934) in the late sixteenth century, during the doctrinal controversies following the death of Martin Luther, but it is best known in the pre-Zeiss era as the birthplace of German idealism and Romanticism. Beginning in the late 1790s, Jena's university was home to the pillars of contemporary German intellectual thought, from the idealist philosophers like Hegel, Schiller, Fichte, and Schelling, to the early Romantics, including Goethe, Schiller, Novalis, and Schlegel.

This intellectual atmosphere was diminished in the decade after the Napoleonic invasion of Prussia - the war took its toll both on the student body of the university and its finances, driving those intellectuals who still lived there away from the city.[131] [*Figure 3.2*] Nonetheless, Jena, and its sister city of Weimar, where Goethe, Schiller, and others had also lived, retained its status as a legendary site of humanistic thought; even today, the city is studded with memorial plaques and statues commemorating quotidian moments in the lives of its most famous literary residents.

The foundation of Carl Zeiss's optical workshop in 1846 marked a transformation of Jena's cultural landscape, and the beginning of its industrialization. Originally situated on the outskirts of the old city center, Zeiss's workshop started by specializing in the manufacturing of optical lenses and small scientific instruments for the university's growing chemistry and biology departments. After Zeiss began a partnership with Ernst Abbe, a university physics lecturer, in 1866, the workshop expanded its operations and

[131] The Battle of Jena, fought alongside the Battle of Auerstedt (a nearby village), was a humiliating loss for the Prussian Army, and a historic victory for NApoleon. Over the course of a single day on 14 October 1806, the Prussian army suffered more than 23,000 casualties and lost more than 15,000 troops as prisoners of war to France. An apocryphal story has Hegel, then a professor at the university, writing the *Phenomenology of Spirit* as the battle raged on the outskirts of the city. The battle paved the way for Napoleon's march to Berlin, and left Jena in shambles.

gained a national reputation for microscope manufacturing. The specialization into microscopes was later supported by a collaboration with the local glass chemist Otto Schott, and this collaboration made Zeiss able to manufacture optical instruments with far greater precision and at a much faster pace than any of its competitors. Over the next few decades, Zeiss expanded its product lines beyond microscopes and telescopes to include measuring devices for geological and medical purposes, as well as cameras and photo processing equipment. By the advent of World War I, Zeiss was a major fixture not just of the local industrial landscape, but of Germany as a whole, and had an established international reputation.[132] "Whether on land, on water, or in the emerging field of aviation," wrote Rolf Walter in his official history of the company, "Zeiss instruments were everywhere."[133]

Zeiss's growth transformed the physical as well as the cultural landscape of Jena. In its early years, the manufacturing operations were limited to a small array of buildings on the southern edge of the city, but as production needs grew, the company began to expand into the center of the town. At the turn of the twentieth century, Zeiss underwent an unprecedentedly fierce "unrestrained expansion" into the center of the city, transforming

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[132] For more on Zeiss company history during this time, see Edith Hellmuth and Wolfgang Mühlfriedel, *Zeiss: 1846-1905. Vom Atelier für Mechanik zum führenden Unternehmen des optischen Gerätebaus,* Carl Zeiss: Die Geschichte eines Unternehmens, ed. Wolfgang Mühlfriedel and Rolf Walter, vol. (Weimar: Böhlau Verlag, 1996). See also Felix Auerbach, *The Zeiss Works and the Carl-Zeiss Stiftung in Jena: Their Scientific, Technical, and Sociological Development and Importance Popularly Described*, trans. Siegfried Paul (London: Marshall, Brookes, and Chalkley, 1904). The Zeiss company was unique among 19th-century industrial firms in that Ernst Abbe, who ran the company after Zeiss's death in 1888, allotted a significant amount of the firm's income to a trust (*Stiftung*) which permanently gave a certain percentage of profit to the university to support scientific research, and supported other local initiatives. The Zeiss firm was also incredibly progressive in its treatment of its workers, guaranteeing them, for example, an eight-hour work day, a minimum fixed salary for all employees, pensions, paid vacation days, a collective fund to pay for sick leave, and six months' wages upon dismissal. For more, see Auerbach, 100-123.

[133] Rolf Walter, *Zeiss 1905-1945*, Carl Zeiss: Die Geschichte eines Unternehmens, ed. Wolfgang Mühlfriedel and Rolf Walter, vol. 2 (Weimar: Böhlau Verlag, 2000), 59.

an area that had previously been characterized by "villas, social clubs, and gardens" into one dominated by sixteen massive modern industrial buildings.[134]

This colonization of Jena's city center was visually arresting not just in terms of the sheer scale of the takeover, but also in its architecture. By 1915, Zeiss occupied nearly forty thousand square meters of real estate in a massive complex of buildings that included manufacturing plants, research labs, a library, offices, and an observatory on the roof.[135] [*Figure 3.3*] The complex dominated the geography of Jena, dwarfing the university buildings nearby and pushing residential spaces further out past the edges of the old city, across the Saale river and up into the foothills of the Harz mountains. The buildings themselves were constructed with reinforced concrete, a relatively new construction material popularized by engineer Gustav Wayss in the 1870s, and their style was brightly modern; sharp right angles, flat roofs, and facades made mostly of large windows.[136] Occasionally the broad surfaces and angles were accentuated with some flourish, like the small polygonal tower, with an open balcony and terraced roof, at the northwest corner of Building 12, completed in 1913, or the small observatory on top of Building 10 (finished in 1911), for testing telescope prototypes.[137] Smokestacks bounded the campus to the north and the south. This massive complex looked radically different from its surroundings – half-timber houses and the dense stonework remains of the old medieval castle – and this

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[134] Bertram Kurze, "Die Bauten 11 und 23 von Carl Zeiss Jena," in *Die Welten Maschine: Beiträge zur frühen Geschichte des Zeiss-Planetariums Jena* (Jena: Ernst-Abbe Stiftung, 2010), 63.

[135] ibid. This transformation is measurable not just in the topography of the city, but also in the resident numbers. In 1890, Zeiss workers comprised about 2.8% of the city's total population. In 1914, by contrast, nearly 10% of the city's inhabitants worked for Zeiss. See Meike Werner, *Moderne in der Provinz: Kulturelle Experimente im Fin de Siècle Jena* (Göttingen: Wallstein Verlag, 2003), 32.

[136] Emil Mörsch, *Der Eisenbetonbau, seine Theorie und Anwendung* (Stuttgart: K. Wittwer Verlag, 1908), 216-17.

[137] Kurze, 64

dramatic juxtaposition prompted local protests against the development and demands that future construction work "be based more on local urban and architectural considerations."[138] [*Figure 3.4*]

This contrast, and conflict, between the Zeiss buildings and the rest of the old city encapsulates a larger tension between the old Jena, home of the Romantics and Idealists and one of the greatest legacies of German thought, and the new Jena, dominated by scientific research and industrial innovation. "The one-time quaint and unpretentious University town," wrote Felix Auerbach, a professor at Jena and a frequent collaborator with Zeiss, in his 1903 account of the company, "has become a hive of industry, throbbing with life and activity."[139] Zeiss, in his estimation, had brought Jena into the modern era, up to the very forefront of technological and social innovation.

Crucially, however, Zeiss positioned this transformation as a logical continuation of Jena's past, rather than an abrupt break with it. In contrast to its critics, who might "look back with sorrow and regret upon the change which has come o'er the scene," Zeiss saw itself as the inheritor of the city's profound intellectual tradition, rather than an usurper. Auerbach makes this explicit when he brings the words of Goethe to bear on Zeiss's accomplishments:

> The Jena of the past was the first Faust, the Faust of the study; the Jena of the present is the second Faust — plunged in the realities of existence, vigorously and strenuously helping to raise up the great dike against the ocean of misery and vice which threatens to overwhelm our civilization.[140]

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[138] quoted in Kurze, 63.
[139] Auerbach, 133.
[140] Auerbach, 134. Auerbach here paraphrases from Goethe's *Faust II* Act Five, Scene One, in which Philomen speaks to the Wanderer first of how the sea began to overtake the land when he was too feeble to beat it back, and then of his master, Faust, whose "daring minions / Drained and walled the ocean bed, / Shrank the sea's entrenched dominions, / To be masters in her stead." Johann Wolfgang von Goethe, *Faust*,

This perception of continuation, the conscious historical awareness that informed the construction both of the physical buildings and the corporate identity more broadly, was only intensified after the war, especially in the new fields of research Zeiss established. The armistice and the ensuing Treaty of Versailles eliminated or drastically reduced large swaths of German manufacturing and engineering, and many companies, such as the camera firm C.P. Goerz, declined precipitously and eventually folded.[141] Zeiss was hit especially hard. In the waning years of the war, Zeiss had devoted most of its production to the manufacture of instruments useful in the war effort, such as telescopes, binoculars, and other observational devices. By 1918, for example, nearly 93 percent of Zeiss's sales were to the German military.[142] The Versailles Treaty and its heavy restrictions on arms manufacturing dropped that number to zero.[143] Faced with heavy restrictions on the manufacture and export of anything deemed "war material," the company undertook a "systematic search for new fields of products" in order to "rebuild [its] own prominence in the world market," which had been so diminished after the war.[144] Economic historians of the Weimar period have argued that the economic pressures of this period were not as dire as contemporary commentators made them out to be. However, Zeiss's explicit articulation of its expansion into new fields as a response to these restrictions indicates that, whether

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trans. Walter Arndt (New York: W.W. Norton and Co, 2001), 314.† ["kühne Knechte / Gruben Gräben, dämmten ein, / Schmälerten des Meeres Rechte, / Herrn an seiner Statt zu sein."]

[141] Goerz officially folded in 1926, was bought out by Zeiss, and was transformed (along with several other failed camera companies - the Internationale Camera Aktiengesellschaft, Contessa-Nettel, and Ernemann) into Zeiss Ikon, the camera division of the Zeiss foundation.

[142] Walter, 74.

[143] Peace Treaty of Versailles, Chapter II "Armament, Munitions, Material" (1919)

[144] Wolfgang Wimmer, "Strategie oder Zufall: Wie der Geschäftsbereich Planetarien bei Carl Zeiss entstand", in *Die Welten Maschine: Beiträge zur frühen Geschichte des Zeiss-Planetariums Jena* (Jena: Ernst-Abbe Stiftung, 2010), 93.

or not it was rooted in economic reality, Zeiss felt increasingly anxious about its profit margin.

This effort led to expansions into several different fields, some failures and some largely successful, including an ill-fated attempt to develop furniture and a slightly more successful venture into medical instruments. The largest shift was to what Zeiss historian Rolf Walter has called the "measurement revolution," an increased dedication to the development and manufacture of precision measurement instruments, and a corollary reduction in observational instruments. Walter characterizes this turn in the context of a "series of rationalization crazes that swept the industrial world," to which Zeiss was responding, aiming to position itself as the premier manufacturer of precision measurement.[145] This led to the foundation in 1919 of a new division under the name of "Feinmess," which acted as an umbrella group for all these experimental expansions, and marked a significant departure from the company's longstanding specialization in optics. This division was appointed, as all Zeiss divisions were, a head scientist to direct product development. As official company archivist Wolfgang Wimmer has noted, the bulk of the products contained in the new "Feinmess" division were not, in themselves, new; many, especially the chemical analysis instruments, had already been sold for some time under different division names, and in the larger world of measuring apparatus sales, few of Zeiss's contributions were particularly revolutionary. However, with the new division name, and the new division scientist, Otto Eppenstein, the *Feinmess-Abteilung* products could claim a thorough scientific pedigree, far beyond what most of their competitors could

[145] Walter, 118.

offer.[146] Though Zeiss restarted optical instrument manufacturing after the official reformation of the *Reichswehr* (the standing army, which had been disbanded with the Treaty of Versailles) in 1921, this new, non-optical, branch of research and production remained, and was responsible for the rebuilding of Zeiss's reputation abroad.

The expansion of the *Feinmess-Abteilung* was accompanied by the growth of other non-military divisions as well, including the Astronomy Division, which in 1923 moved to occupy the entirety of Building 11. Simultaneous with this larger reworking of Zeiss's corporate identity, the Astronomy Division's small planetarium working group that was collaborating with the Deutsches Museum developed their first projection prototype. The idea to use projection rather than installing individual lights on the surface of the dome had first been articulated in 1917, and developed into a prototype design by 1919, but it was not until 1923 that the first working model was finished. Simultaneous with the work on the projection apparatus, another engineering team within the Astronomy Division began the development of a dome in which the projection could be housed.[147]

The prototype of the Mark I projector, destined for the Deutsches Museum, debuted on the roof of Building 11, part of the 1913 addition to the company campus, in August 1924.The fabric dome stood out sharply against the roofs of the rest of the complex; even the older observatory dome on Building 10 was noticeably smaller and more decorative than the planetarium structure, which was large, perfectly round and smooth, and looked, as one if its engineers, Walter Bauersfeld, put it, like nothing so much as "a circus tent."[148]

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[146] Wimmer, 95.
[147] The dome construction group later patented the technology, and Carl Zeiss formed a new limited liability corporation, the Firma Kuppelbau GmBH, to manage the patent.
[148] Kurze, 65.

Bertram Kürze calls the dome's engineering a "modern and epoch-making […] revolutionary" feat of innovative concrete and steel construction that made its inventors (Bauersfeld and others) some of the "most important engineers of this past century."[149] [*Figure 3.5*]

This four-year spread, between prototype sketches and the actual model, brackets the most volatile period of Weimar hyperinflation, and Zeiss's greatest period of uncertainty. Contextualizing the development of the planetarium in this moment helps illuminate why the Zeiss Company decided to turn the planetarium from a one-off collaboration for the Deutsches Museum alone into a marketable product it could sell, both domestically and abroad.

Walter Villiger, head of the astronomy division of the Zeiss company, wrote an official account of the invention of the planetarium in 1926, two years after the first prototype and a few months after the Mark I's premier in Munich. In describing how the company came to decide to continue developing the projection technology, he attributed it to the enthusiasm expressed by the visitors during this test run:

> There have been rather a large number of suggestions from visitors who came and saw the Planetarium in operation to continue to develop the apparatus. The builders themselves have had such rich experiences through the many demonstrations and the truly lasting impression that they have all had on them. All of these factors have prompted the apparatus's constructors to make the future set-up of the machine more versatile.[150]

[149] Kurze, 67. It is also worth noting here that Zeiss developed this dome construction nearly twenty years before R. Buckminster Fuller designed his geodesic dome around the same principles. It's unclear to what extent Fuller based his design on Bauersfeld's Zeiss model, but the basic principles of both are the same: a lattice of triangles made out of steel, which makes the structure nearly perfectly hemispheric, extremely stable, and able to bear a great deal of weight.

[150] Walter Villiger, *Das Zeiss-Planetarium* (Jena: Vopelius Verlag, 1926), 25.

In his 2000 official history of the company, Walter accounts for the Zeiss adoption of the planetarium as an official member of their product line as a predominantly business-minded decision focused on the perception of the company:

> Zeiss recognized the planetarium as a building block [for the reconstruction of the company], that very soon after its invention was thrust into the limelight and seen by an audience of more than a million. Even if [the reasoning went] the planetarium never contributed greatly to company revenue, its value was not so much monetary as it was in the less tangible realm of advertising and "good will;" and finally, the large-scale orders brought a not inconsiderable effect on employment in Jena.[151]

In his article "Strategy or Coincidence: How the Planetarium Division at Carl Zeiss Came to Be," Wimmer argues that even before the prototype's test run success, Zeiss was already considering making the planetarium part of its suite of apparatuses, but that the test run solidified its place in the company:

> They couldn't, despite what those in Munich may have thought, keep the planetarium as a Deutsches Museum exclusive. Targeted marketing, however, did not begin until November 1924. It is therefore apparent that it wasn't until the test run on the roof of the Zeiss Headquarters starting in August 1924 that the enormous potential of the audience was recognized.[152]

Wimmer complicates Walter's account when he argues that "overall, there is little evidence that Carl Zeiss was diversifying into the planetarium because it wanted to grow the company or because they wanted more work for their employees."[153] Nonetheless, because "a great deal of money and labor" had been invested in its development, and because there was opportunity for "further technological development" and "immediate

[151] Walter, 127-28
[152] Wimmer, 95.
[153] Wimmer, 96.

demand," the company continued to put work into the planetarium. "They continued," Wimmer concludes, "down the technological path that they themselves had forged."[154]

All these accounts, though they vary in particulars, agree on the same basic narrative: that the company saw potential in the planetarium after its wildly successful showing in its trial run, and while Zeiss acknowledged that it would never make a great deal of profit off the device, some other quality drove it to continue developing the apparatus. For Wimmer, that something is rather practical – the realization that they had already poured a great deal of resources into it, and that it wasn't a total failure, so they might as well. For Walter, it is mostly that Zeiss recognized the planetarium's capacity for fostering "good will," a quality, he implies, that is priceless. For Villiger, close as he was to the conception and realization of the machine, what truly attracted the Zeiss company to the planetarium was something emotional – the "rich experiences" (*reiche Erfahrungen*) and "lasting impressions" (*nachhaltige Eindruck*) created by the planetarium. [*Figure 3.6*]

In his early 1925 review of the prototype's performance in the Copenhagen journal *Politiken*, Elis Strömgren, director of the Royal Danish Observatory, reflected not only on the planetarium's promising potential, but also the way in which it so effectively connected Jena's divergent historical legacies:

> Jena has cultural ancestors. In Jena many of the greatest names of German intellectual life are connected: Goethe and Schiller, Leibniz, Hegel, Fichte, Novalis, Schelling, Nietzsche… The Jena of today of course has rather less to do with philosophical systems than it did in days of yore, and poetry in Jena has certainly known better days, but this modern Wonder of Jena contains so much fantasy, so much poetry, that it can easily be considered in the same breath as the giants of German poetry who came before. This time, a Nitro Lamp, a number of projection devices, a gear train, and several

[154] Ibid.

> meters of electrical wire are the ingredients, and the result: a beautiful work of art.[155]

Strömgren's "Wonder of Jena" epithet was an illusion to another Jena tradition, of which many readers would have been aware. The "Wonders of Jena" were a collection of seven geographic and man-made landmarks in Jena, assembled in the mid-seventeenth century by university students. The seven wonders ranged from majestic to absurd – *Ara* (the passageway under the altar of the Church of St. Michael in the center of the city), *Caput* (a mechanical figure on top of the town hall clock that chimed a bell on the hour), *Draco* (a seven-headed pâpier-maché dragon made by students), *Mons* (the limestone Jenzig mountain to the south of the city), *Pons* (a massive arched bridge across the Saale river, with a chapel halfway across), *Vulpecula Turris* (the Fox Tower, a medieval castle keep on a nearby small mountain), and *Weigeliana Domus* (the home of 17th century mathematics professor Erhard Weigel, which featured rudimentary indoor plumbing and skylights) – and were originally intended as a kind of passcode, a way for students to demonstrate that they really had spent time in Jena and knew of its secret delights. By the 20th century, the Wonders of Jena were well-known quirks of the town, evidence of its long history. Strömgren's epithet for the planetarium explicitly drew on this knowledge, connecting the old legacy of the town to its future. The Zeiss company seized on this name, and featured it regularly in advertisements, correspondence, and other official materials; calling the planetarium the "modern Wonder of Jena" located it firmly within Jena's cultural heritage.

[155] Elis Strömgren, quoted in Villiger, 11.

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From its inception, the planetarium was closely entangled with Jena, and the Zeiss company's perception of its role there. Even before the opening trial run, word of the planetarium spread through Jena and the surrounding Thuringian countryside, and calls for a permanent installation in Jena came alongside complaints that Munich would get one first. In November 1923, the *Jenaische Zeitung* reported on the Zeiss collaboration with the Deutsches Museum, noting that "Jena must content itself with the fame of being the birthplace of the technical wonder (*technischen Wunders*). If the inhabitants of Jena actually want to see it, they'll have to travel to Munich!"[156] Franz Fuchs, Astronomy Director of the Deutsches Museum, wrote a report of the machine's success in the *Jenaer Volksblatt* some weeks later, and an editor added a note reminding his readers that the planetarium would be in the temporary dome for some time before being shipped off to Jena, and that it would "*certainly* be made available to the population of Jena," and advised them to take advantage while they could.[157] Nearly a year later, however, Jena had yet to have a real planetarium of its own. The *Volksblatt* noted in October 1924 that "there has been a general wish [among residents of Jena] that the Zeiss company build a permanent planetarium here. For although the Deutsches Museum in Munich, to whom the planetarium was intended as a gift, has the first claim to it, Jena, as the birthplace of this

[156]Quoted in Hans Meinl, "Die Kontroverse um das Jenaer Planetarium," in *Die Welten Maschine: Beiträge zur frühen Geschichte des Zeiss-Planetariums Jena* (Jena: Ernst-Abbe Stiftung, 2010), 97.
[157] Franz Fuchs, "Die beiden Planetarien im Deutschen Museum," *Jenaer Volksblatt* 34, no. 263 (15 Nov 1923), 3-4.

technical wonder (*technischen Wunderwerkes*) should not have to stand behind it [Munich]."[158]

Nonetheless, it would take two more years for the Jena planetarium to officially open, and the intervening time was characterized by a series of controversies over the role of the planetarium, and the Zeiss company more broadly. These controversies, carried out in regional press reports and local government meetings, challenged the dominance of Zeiss in both the literal and cultural landscape of Jena, and forced an explicit articulation of the planetarium's role in the town's cultural heritage.

The controversies crystalized into two main issues: the location, and the design. Even before Zeiss had shipped the first fully functional projector to Munich for its installation, plans were already underway to build a permanent structure for one in Jena itself. Before Zeiss had even explicitly announced its desire to build a permanent planetarium to the city government, a local architectural firm, Schreiter and Schlag, submitted a set of blueprints to the town hall, laying out their construction plan for a planetarium built in a corner plot of the Prinzessinnengarten.

The Prinzessinnengarten was a lightly wooded garden in the English landscape style in the northern corner of the city, about 700 meters as the crow flies north of the Zeiss campus, and across the street from the university library. It shared a plot of land with the Botanical Garden, which dated back to 1548 and had most famously served as the inspiration for Goethe's *Metamorphose der Pflanzen* in 1790. [*Figure 3.7*] The Prinzessinnengarten (the Princess Garden) itself was named for the "princess castle" that

[158] "Heimatschutz gegen Planetarium?" *Jenaer Volksblatt* 35, no 236 (7 October 1924), 2.

sat on its grounds, which was the local nickname for the fanciful garden house built by Johann Jakob Griesbach, a contemporary of the German Romantics and a founder of modern New Testament criticism. [*Figure 3.8*] To the west, it shared a border with the Johannis Cemetery, where Carl Zeiss himself had been buried. In sum, the Prinzessinnengarten area was studded with landmarks and artifacts from Jena's Romantic past. At some point during Zeiss's late nineteenth century expansion, the Zeiss foundation (the *Stiftung*, which operated largely independently from the main company and was primarily concerned with supporting the university and city infrastructure) had bought some part of the Prinzessinnengarten plot, thus making it legally possible for Zeiss to build on the land.[159]

Nevertheless, approval for the site had to go through not only the local building commissioner, who informally approved of the idea already, but, because of the historical significance of the land, also had to go through the *Thüringische Beratungsstelle für Heimatschutz und Denkmalpflege* (the Thuringian Advisory Board for Homeland and Monument Preservation).[160]

The *Heimatschutz* movement in Jena had originated several decades earlier, with a 1904 petition about a proposed restaurant and hotel on top of the Jenzig mountain (the *Mons*). The proposed structure was to feature a tower, which the author of the petition (a well-known local publisher) found to be offensively anachronistic. Instead, he proposed,

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[159] When Schreiter and Schlag submitted their building plans to the city council, there was as yet no official documentation of Zeiss's intentions to build a permanent planetarium in Jena. However, as Hans Meinl, Deutsches Museum historian, has noted, it "can only be assumed that they had insider knowledge," because their plan included detailed sketches of the dome construction, and the dome's patent had not yet been formally issued. Meinl, 98.

[160] *Heimatschutz* is also the contemporary translation of that most American of institutions, Homeland Security, but in this context, *Schutz* refers more to "preservation" than "protection."

that "in the interest of the protection of the natural beauty" of the mountain, a structure should be built "in a style appropriate to the area."[161] From this protest emerged an official city group dedicated to the preservation and protection of natural monuments. Over the next few years, however, the *Heimatschutz* project expanded to include cultural heritage as well. Many of the organizations projects in this arena were dedicated to the preservation and exhibit of artifacts and spaces from Jena's philosophical tradition, including a 1905 exhibit on Schiller's Jena home. By 1924, when the planetarium's design was moving among city offices, the Board for Homeland and Monument Preservation had overseen the curation of several additional exhibits on German Romanticism and Idealism, as well as several campaigns on the continued preservation of the Jenzig mountain.

It was here that the planetarium construction plan met with unexpected opposition. In its October 1924 update on the issue, quoted above, the *Jenaer Volksblatt* laid out the terms of the controversy most clearly:

> When in the last few months of summer more and more crowds of people from out of town flocked (*strömten*) to Jena to pay a visit to the planetarium, temporarily housed in Zeiss's dome, there was satisfaction (*Befriedigung*) and joy (*Freude*) felt in the widest circles, that our city should once again have become an attraction for outsiders. […] Apparently, however, there are people in Jena who disagree, and who have the necessary influence to succeed with a veto.[162]

The *Volksblatt* had obtained a copy of the protest letter written by members of the preservation board, in which they called the planetarium building plan both an "attack" and a *Schildbürgerstreich* – an unforgivably foolish idea – but acknowledged that the intent of

[161] Meike Werner, *Moderne in der Provinz: Kulturelle Experimente im Fin-de-Siècle Jena* (Göttingen: Wallstein Verlag, 2003), 93.
[162] *Jenaer Volksblatt* (4 October 1924), 2.

the Zeiss company, to "make this miracle of the human spirit (*Wunderwerk menschlichen Geistes*) accessible to this city," was laudable.[163] "It is only," they continued, "that the Prinzessinnengarten must be preserved in its present form."[164]

Ultimately, these objections were dismissed, largely because Zeiss already owned the property. The fact that Zeiss owned the historic Prinzessinnengarten highlights how Zeiss saw its obligations to Jena, and how it saw its own company legacy as part of Jena's illustrious intellectual history, rather than a break from it. The purchase of the garden staked a claim to Jena's cultural, as well as its literal, landscape. That Zeiss chose to build the planetarium there, rather than develop it for other company purposes, or leave it alone entirely, highlights as well the particular role the planetarium played in Zeiss's relationship with Jena.

When Zeiss received final approval for its building plans in the Prinzessinnengarten, they broke ground on the site and began building the planetarium according to Schreiter and Schlag's original design. By November 1924, the foundation for the dome was laid, and scaffolding to support the erection of the dome was under construction. Despite the delay from the preservation board, the Jena planetarium was underway well before the actual planetarium projector was delivered to Munich for its official public debut. By March of 1925, the dome was complete, and the supporting offices were under construction.

Schreiter and Schlag's design was simple. The interior projection dome was 25 meters in diameter and had space for 400 seats, along with a moving track for the projector

[163] Ibid.
[164] Ibid.

to be wheeled in and out of the room, as well as a lecturer's booth at the back of the theater. One hundred-eighty-four of the seats were arranged in a semicircle facing south, while additional seats were crowded into the southern half of the floor plan, most facing east and some facing north.[165] The building was dominated by the planetarium dome, with only a small foyer for a ticket booth and lavatories added to the front. [*Figure 3.9*]. An English-language architectural account of the building from 1927, which Zeiss circulated abroad as a detailed example of the building requirements for other planetaria, describes the pared-down efficiency of the structure. The building relies on steam heating, for example, but only to about twelve degrees Celcius (about 53 degrees Fahrenheit), because "since no cloakroom is provided the spectators would be expected to keep themselves sufficiently warm in winter by retaining their overcoats or wraps."[166] The only adornment to the outside of the building was the low, covered verandah around the dome, and the large columned porch in the front, intended to provide shelter for visitors waiting for the show to begin. [*Figure 3.10*]

Schreiter and Schalg were not the only architects to propose a design; though their close relationship with Zeiss ensured their success from the beginning, news of a possible Jena planetarium spread through the architectural community and attracted the attention of Adolf Meyer. Trained as an architect in Düsseldorf, Meyer began collaborating with Walter Gropius in 1910, nine years before Gropius founded the Staatliches Bauhaus in Weimar.

[165] Typically planetaria arranged seating facing south, since the bulk of celestial objects and phenomena are located in the southern part of the sky. The additional seats arranged in the southern half of the room were less ideally positioned, and therefore slightly cheaper.
[166] "Dome Structure for the Projection Planetary as erected at Jena as per Drawing No. 51 95 1," 1927, CZ Archiv BACZ 27341.

When Gropius opened the Bauhaus school, Meyer followed and taught architectural design and construction.

The foundation of the Bauhaus in Weimar, about twenty-five kilometers away from Jena, brought an influx of contemporary artists, architects, and designers to the region. While most were centered in Weimar, some also operated in Jena. The Jena contingent was supported largely by the Jenaer Kunstverein, an artists' society founded in 1903 by Botho Graef, an archaeologist at the University of Jena and a patron of German Expressionist artists like Ernst Ludwig Kirchner. Throughout this period, the Kunstverein was generously supported by the Zeiss Company's public-facing Ernst Abbe Stiftung. At first glance, the Kunstverein is not necessarily an obvious recipient of the Abbe Stiftung funds, which usually went to scientific research and education at the university. However, Zeiss's awareness of its place in the storied legacy of Jena meant that it leant support not just to scientific endeavours, but to artistic ones as well.

As we shall see, the planetarium was one of its most explicit efforts to draw a clear link from Jena's romantic heritage to the modern Zeiss project, but even at the turn of the century, when Auerbach was writing of Jena's rebirth as "the second Faust," the Zeiss company was attempting to link the arts heritage of the city with modern science and scholarship. Meike Werner, in her 2003 study of modernism in fin-de-siècle Jena, has shown that Zeiss, and the Abbe Stiftung, was actively participating in an early culture of modernism that arose in Jena around 1900. Werner argues that modernism, typically thought of as a predominantly metropolitan movement in the early twentieth century, can also be found in smaller provincial cities, where local artists and intellectuals experimented with modernist forms and local cultural heritages. In Jena, local actors (Werner focuses

largely on the community of publishers) engaged in an attempt to revive Jena's cultural reputation for the new century, focusing not just on its literary and aesthetic traditions, but also on its more recent scientific fame. The Abbe Stiftung, devoted as it was to supporting public intellectual projects within Jena, was in a prime position to assist. In particular, the Stiftung gave a large sum of money towards to the foundation of the Kunstverein.[167] As we will see, the Kunstverein was a key part of the planetarium's reception in the mid-1920s. Thus what emerged, in Werner's account, was a turn-of-the-century exploration of a Jena modernism, in which art and science together brought Jena into the future.

In 1914, leadership of the Kunstverein passed to two other professors at the university, the archaeologist Herbert Koch and the philosopher Eberhard Grisebach. During their tenure, the Kunstverein actively supported Bauhaus activities, largely in the form of regular exhibitions and expositions of Bauhaus design work. The Kunstverein's support of Bauhaus projects in this period was largely due to the influence of Walter Dexel, who Koch and Grisebach appointed to the board in 1916. Dexel, a painter and sculptor in his own right, was heavily influenced by the Soviet Constructivist movement, as well as its Dutch counterpart, De Stijl, and he made an active effort to give these contemporary movements, as well as German Expressionism and, later, the Bauhaus, a platform in the Kunstverein. This support took the form of a series of exhibitions from 1919 to 1928, which Dexel designed and curated. Artists represented at these exhibitions included Wassily Kandinsky, Laszlo Maholy-Nagy, Josef Albers, Herbert Bayer, Walter Gropius, and Adolf Meyer. Even after Gropius relocated the Bauhaus to Dessau in 1925 when the state

[167] Werner, 35.

government of Thuringia cut off funds for the school, Dexel continued to host annual group exhibits that included Bauhaus contributors.[168]

The establishment of the Kunstverein, and then the appearance of the Bauhaus nearby sixteen years later, has been framed as a return to, or an evocation of, Jena's rich cultural past. Volker Wahl, whose 1988 account of Jena's Kunstverein remains the most comprehensive history of the society, wrote that "Jena, which was from 1558 a university city and a 'magnificent focal point of science' [quoting Germaine de Staël], was in the 19th century an artless city."[169] The Kunstverein, according to Wahl, was a rebirth for Jena's cultural life, and brought the city to the very forefront of "the most advanced artistic trends of the time."[170]

Dexel's influence in the society meant that not only more traditional visual forms, like photography and painting, were part of this renaissance, but that larger, more functional works of sculpture, furniture, and architecture, were also prominently featured. Though not a member of the Bauhaus himself, Dexel was drawn to the school's insistence on large-scale functionality as a driving aesthetic factor. He was particularly interested in the architectural works of Gropius and Meyer. This interest is what drew his attention to Meyer's planetarium design. Dexel explores this design in two texts written in early 1926. The first, titled simply "Adolf Meyer," was written early in the year but never published,

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[168] For more, see Volker Wahl, "Jena und das Bauhaus," *Wissenschaftliche Zeitschrift der Hochschule für Architektur und Bauwesen Weimar* 26, vol 4 (1979), 340 – 350; and Volker Wahl, *Jena als Kunststadt: Begegnungen mit der modernen Kunst in der thüringischen Universitätsstadt zwischen 1900 und 1933* (Leipzig: Seeman Verlag, 1988).
[169] Wahl, "Jena und das Bauhaus," 340.
[170] Ibid.

and a more fleshed-out exploration of the design appeared on the front page of *Reclams Universum* in May 1926, as "Planetarium and Planetarium Buildings."[171]

"The planetarium," wrote Dexel in his unpublished essay on Meyer, "is a totally new type of building, a realization of a totally new idea."[172] Dexel elaborates in his *Reclam Universum* article:

> With the invention of the planetarium our architecture is confronted with a completely new problem: the construction of the required demonstration room. Is it appropriate to use for this new theme existing designs that were invented in other times and for other purposes? Does it make any sense to hide the extraordinary inventions of the instrument and the dome behind architectural ornamental forms? Or rather should the goal not be to expose and highlight [these features] to some extent? That is to say, that the task of construction should be to allow all the characteristics of this new invention to come into their own, so that the purpose of the building can be seen directly and completely clearly; in short, that an entirely new type of building is created?[173]

Nonetheless, by Dexel's reckoning, the extant planetaria, as well as the proposed designs for future planetaria, had utterly failed to accomplish this goal, and instead recycled old tropes. "The planetarium as a new type of building," he claimed, "had so far not only not been created, but had not even been attempted."[174] Instead, "the exaggerated representational requirements of a bygone era, which still believed that brilliant technological solutions could still be enhanced with historical, or at least, artistic, facades, still does not appear to have been overcome."[175] Planetaria, he argued, universally relied

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[171] Walter Dexel, "Adolf Meyer (1926)" in *Der Bauhausstil – Ein Mythos: Texte 1921-1965*, ed. Walter Vitt (Starnberg: Josef Keller Verlag, 1976), 85 – 90; Walter Dexel, "Planetarium und Planetariumsbauten," *Reclams Universum* (13 May 1926), 853 – 856.
[172] Dexel, "Adolf Meyer," 85.
[173] Dexel, "Planetarium und Planetariumsbauten," 855-856.
[174] Ibid., 856.
[175] Ibid.

on unnecessary architectural flourishes, like columns, friezes, and "historical or Expressionist decorations [*Schmuckformen*]."

Dexel formed this opinion on the basis of the five extant free-standing planetaria, as well as on available design plans of several more. When the Jena planetarium officially opened its doors on 18 July 1926, it was the fourth planetarium building to open after the Deutsches Museum introduced the first projector in 1925. In the year of the Munich debut, Zeiss received nearly a dozen requests from cities – mostly in Germany, but several as far away as Tokyo – to install a planetarium of their own. Before Jena's was finished, Zeiss had already installed projectors in Barmen, Leipzig, Düsseldorf, and Dresden, though the Dresden planetarium officially opened a week after Jena.

All these planetaria had starkly different designs, but all made liberal use of the old-fashioned decorative elements that Dexel so hated, most notably columns, pilasters, and broad staircases. Barmen's building, which opened on 18 May 1926, was an oversized pumice concrete dome nearly 25 meters in diameter that stood atop a sweeping, shallow staircase. Flanking its entrance hall were two large statues of Venus and Mars reaching up to the heavens. [*Figure 3.11*] Two days later, the Leipzig planetarium opened its doors within the grounds of the Leipzig Zoologischer Garten. The Leipzig planetarium was a stark, dodecagonal building that tapered into a pyramid at the top, with tall narrow doors in an embossed, simplified star pattern. The entrance to the planetarium was flanked by four tall pilasters, a motif echoed in decorative elements around the roof. [*Figure 3.12*] The Dresden planetarium had a similarly dodecagonal façade as Leipzig's building, but it had a dome instead of a pyramid, and its entrance was an acutely angular portico, with two open arches. The entire façade was covered in regularly-spaced pilasters and a broad

staircase, and was designed, according to its promotional pamphlet, to appear as an "imposing […] temple to the heavenly goddess Urania."[176] The Dresden promotional pamphlet made explicit what Dexel saw as implicit and ubiquitous in all these designs – that they meant to evoke an antique sense of grandeur usually associated with grand buildings of the past ("the old, familiar look of our theaters, museums, and above all, our public buildings").[177] [*Figure 3.13*]

The only extant planetarium to escape the full brunt of Dexel's derision was the Düsseldorf planetarium, which opened on 23 May 1926. By far the most dramatic of the buildings considered by Dexel, the Düsseldorf planetarium was the centerpiece of an enormous hall constructed on the banks of the Rhein.[178] This Rheinhalle was one of several monumental buildings designed by the architect Wilhelm Kreis for the GeSoLei exposition (*Große Ausstellung Düsseldorf 1926 für Gesundheitspflege, soziale Fürsorge und Leibesübungen* [the Great Exposition of Düsseldorf 1926 for Public Health, Social Welfare, and Physical Fitness]) that ran from May to October 1926. The planetarium was situated at the center of the hall, while cavernous rooms surrounding it contained other spaces for exhibits on sports and public health. The central feature of the building was the planetarium dome and the wide cylindrical wall surrounding it, which was then enclosed

[176] Kurd Kisshauer, *Die Planetarium der Stadt Dresden* (Dresden, 1926), 11.
[177] Dexel, "Planetarium und Planetariumsbauten," 856.
[178] The style of this building is generally considered to be a neo-classicial expressionism (though expressionism as a movement was largely passé by 1926). In *Pläne, Projekte, Bauten: Architektur und Städtebau in Düsseldorf 2000 bis 2015* (Düsseldorf: Braun Verlag, 2007), Sophie Steybe and Chris van Uffelen describe it as a "neo-classical façade with Expressionist interior decoration," and suggest that it might be considered a particular type of "rheinish expressionism." Steybe, 590. Another architectural historian wrote of the building that "From the Expressionism of the Tonhalle, with its emphasis on emotion and in whose dome there was originally a planetarium, the style spectrum extends as far as the powerfully solemn Neoclassical elements, in which the monumental architecture of the 1930s and 1940s already clearly makes itself clear." Helmut Ricke and Bettina Baumgärtel, *Museum Kunst Palast* (Paris: Fondation BNP Paribas, 2003), 17.

by a square of outer walls. The whole enormous structure was decorated with thick columns separated by tall narrow windows that came to angled arches at the top. The front entrance was flanked by tall sculptures, muscular men and women reclining on concrete pillars standing more than ten feet tall. [*Figure 3.14 and 3.15*] A precisely manicured lawn, studded with topiaries and rose bushes, spread out in front of the wide entrance steps. The Düsseldorf planetarium distinguished itself from its contemporaries not only by its sheer size, but also by the architect's explicit aesthetic mission. Wilhelm Kreis considered himself a conservative architect positioned against avant-garde movements like the Bauhaus, De Stijl, and the Neue Sachlichkeit, and his buildings usually explicitly evoked classical design. In a review of Kreis's GeSoLei buildings, the cultural magazine *Querschnitt* wrote that Kreis's buildings constituted an architectural renaissance that married classical and modern elements with "beauty and recklessness."[179]

It is perhaps surprising then that Dexel, who loathed all things ornamental, did not hate the Düsseldorf planetarium on sight; to the contrary, he considered the Düsseldorf planetarium alone to be the closest of any of the exisiting planetarium designs to the ideal form, "the most valuable artistic achievement yet."[180] The Düsseldorf building's commitment to vertical motifs acheived a "uniform and monumental effect," and the result was a building that looked "festive [*festlich*] and representative."[181] Nonetheless, the Düsseldorf planetarium still suffered from too much ornamentation, so that "the actual building is completely in the background."[182] "All these experiences," concluded Dexel,

[179] Arthur Schlossmann, "Gesolei und Kunst," *Querschnitt* 6, no. 5 (Mai 1926), 356.
[180] Dexel, "Planetarium und Planetariumsbau," 856.
[181] Ibid.
[182] Ibid.

"awake a desire for a real and unambiguous solution to this clearly defined construction issue."[183]

"It is completely incomprehensible," he wrote in his private notes on Adolf Meyer, "that almost all previous planetarium builders have sought to solve the task [of constructing a planetarium] in such a way that they conceal the domed construction, which is equally beautiful and ingenious, and which ultimately represents nothing more and nothing less than the solution of a centuries-old problem [of how to construct a dome]."[184]

Even Jena's planetarium – *especially* Jena's planetarium – did not escape Dexel's scorn. In a 1925 unpublished reflection on the state of Jena architecture, Dexel laments that the city is full of dreadful construction, and the newer buildings of the Zeiss company are especially egregious in their lack of innovation and style. He spins a tragic tale of disappointment:

> In the evening I visit my friends, and I don't want to gossip [*plaudern*]; they are wise people and always have taste. I am describing my view [that Jena architecture suffers from a total lack of vision or style] – they admit I am right […] but then – I am told – our planetarium!! And so then I am looking forward to that. One of the most ingenious inventions of our day -- with such a world-class company as the builder [i.e., Zeiss] – this building had *better* be something totally outstanding. So then with heightened expectations, I scarf down my breakfast the next morning and hurry over to the Prinzessinnengarten. – I have often been disappointed in life, but rarely so acutely. – Has every man in Jena been blindfolded three times over?? I stumble and splutter inwardly … such an invention … by such a world-class company … and such a building as this? A modern dome, weirdly built up and supported; at arbitrary points the roof is brutally stabbed by a weird Grecian porch – in vain I am trying to understand how the lovely inventors, how this world-class company could be induced in any way to take the task

[183] Ibid.
[184] Dexel, "Adolf Meyer," 86.

> of building a planetarium *so* unseriously? Should this be the result of a competition for Germany? For Europe? For Thuringia or for Jena???[185]

Dexel's baffled outrage here has two directions: the first is aimed toward design, so that the failure to adequately honor the inherent beauty of the dome is especially egregious; and the second toward a sense of honor. The bad style of the Jena planetarium is a betrayal not just of the dome, but of Zeiss, and of Jena itself. Dexel's call to improve the planetarium stems not just from a commitment to modern design practices, but also from a sense of obligation to his city, and the wondrous machine that has been birthed by it.

In the midst of this outrage, Dexel invited Adolf Meyer to submit some architectural designs to one of the Kunstverein's regular exhibitions, . It was here that he encountered Meyer's planetarium model, and discovered at last "a truly creative work, and the first real solution to this new, but so often misunderstood, task, which is of the greatest importance."[186] Meyer's design eliminated all annexes, porticos, verandas, and formal gardens; instead, his schematics raised the projection room up to a second floor and used the ground floor as a space for all administrative offices, as well as the ticket booth, lavatories, and coat room. The dome itself was distinctly elliptical rather than hemispherical; for viewers on the ground looking up, the elliptical shape would be foreshortened and appear as a hemisphere. Instead of any angled walls on the outside, like in Leipzig or Dresden, Meyer's model was a smooth, circular shape, with sixteen tall support columns as the only decorative element. The dome was made out of "an exciting

[185] Walter Dexel, "Jenaer Architektur (1925)," in *Der Bauhausstil – Ein Mythos: Texte 1921-1965*, ed. Walter Vitt (Starnberg: Josef Keller Verlag, 1976), 75. Outraged punctuation reproduced faithfully.
[186] Dexel, "Adolf Meyer," 87.

new construction material" that appeared nearly black, a stark contrast to the bright white of the columns and doors. The entire effect of Meyer's design was striking in its simplicity, and, as Dexel saw it, was a design in which "the idea is manifested so clearly, that artistic effect arises naturally from it."[187] [*Figures 3.16 and 3.17*]

Meyer never formally proposed his design to Zeiss, and there's no indication that Zeiss was ever aware of his model. Nonetheless, his design, and Dexel's encouragement of it, shows that the discussion of planetarium design was playing out in a number of different cultural spaces, each with their own sense of the role of the planetarium in Jena specifically, and the cultural landscape more broadly. For Dexel, the most crucial element of the planetarium, and what made it so important, was the dome itself; any design that did not make the dome a dominant element failed. More specifically, the Jena planetarium itself was for Dexel a central site for the architectural reinvigoration of the city; what should have been, in his eyes, an opportunity for a cultural renaissance, instead was squandered on unnecessary columns and baffling verandas. While Dexel's central concern was how the function of the building determined its form, Zeiss as a corporation celebrated the temple-like designs of the early planetaria, with their staircases and statues, columns and archways. As Strömgren wrote in his breathless review of the apparatus he named the "Wonder of Jena," "it is a school, theater, and film all in one, a lecture hall under the vault of the heavens, and a drama in which the celestial bodies are the actors."[188]

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[187] Dexel, "Planetarium und Planetariumsbau," 856.
[188] Elis Strömgren, quoted in Villiger, 11.

Schreiter and Schlag's design was completed in early 1926, and hundreds of people lined the paths of the Prinzessinnengarten and thronged the open courtyard in front of the planetarium to attend one of the first shows. [*Figure 3.18*] In the first eighteenth months of its operation, it had nearly 140,000 visitors, making it the most-visited planetarium outside of Munich.[189] Though attendance numbers declined sharply after the first year and stabilized to an average of 33,100 annually for the next decade, it remained the third most-visited planetarium in Germany, after Munich and Berlin.[190] It also brought in revenue; in the first eighteen months, it made a profit of 32,343 Reichsmark (approximately 1.9 million in today's US dollar), making it the second-most profitable planetarium as well.[191]

At first glance, Jena's success may seem curious. It was not a large town by any means; the 1925 census registered 52,649 people.[192] By contrast, Barmen had a population of 187,099; Düsseldorf, 432,633; Dresden, 619,151; Lepizig, 679,159; Munich, 680,704; and Berlin, 4,024,165.[193] In its first eighteen months, therefore, the Jena planetarium had more than two and a half times as many people visit the planetarium, as actually lived in the city itself. Even in 1933, which reported the lowest visitor numbers, at 19,901, that number still represented nearly a third of Jena's permanent population.[194] Where were all these visitors coming from?

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[189] "Besucherzahlen im Zeiss-Planetarium Jena," Internal Memo (6 Dec 1934), Carl Zeiss Archive, BACZ 27349.
[190] "Besucherziffern der Zeiss-Planetarium im In- und Ausland: Stand per 30. April 1937," Internal Memo (30 April 1937), Carl Zeiss Archive, BACZ 27349.
[191] Untitled internal memo (2 March 1934), Carl Zeiss Archive, BACZ 27349.
[192] *Statistisches Jahrbuch für das Deutsche Reich* (Berlin: Statistischen Reichsamt, 1929), 11.
[193] Ibid.
[194] "Besucherzahlen im Zeiss-Planetarium Jena" (ff 57, above)

An exact breakdown of visitor numbers from 1927 has not survived, but an account from 1930 indicated that nearly a third of visitors to the Jena planetarium were school children on field trips, usually from surrounding Thuringian towns.[195] These groups typically reserved the entire planetarium and paid a reduced entrance price of 40 pfennig per student, fifty percent less than the usual 80 pfennig admission. In early 1927, for example, 500 students from the nearby city of Erfurt came for a demonstration and lecture on the night sky above Jena, with a final performance in which the machine was sped up faster and faster, until a year's rotation of the Earth happened in a manner of minutes. An untitled Zeiss brochure describing the visit wrote that they "laughed and smiled, these young flowers," as the sky rotated wildly above them.[196]

Without precise visitor records, it is difficult to say for certain who was coming to the planetarium, but the Carl Zeiss Archives have preserved accounts of particularly notable or memorable visitors, and four general populations of people who contributed to these visitor numbers outside of school trips emerge. A significant number came from member societies and hobby clubs from around Germany. In August 1927, for example, 1300 members of the railroad union in Gotha came for three performances. Walter Villiger, in an internal report, remarked that the always-punctual railway men appreciated learning about the punctuality and regularity of celestial phenomena.[197] In early 1928, cars from the Chemnitz chapter of the Allgemeiner Deutscher Automobil Club (ADAC) drove down on an unfortunately wet day, and were, as Villiger wrote in the same internal report,

[195] Untitled internal memo, 1933, BACZ 27349, Carl Zeiss Archive.
[196] Untitled pamphlet, no date, ASTRO 901, Carl Zeiss Archive.
[197] Walter Villiger, Internal Memo, 1928, ASTRO 901, Carl Zeiss Archive.

"reassured, after the wet ride, that even though outside the high heavens were still pelting down in a storm, inside they could find themselves under a radiant and starry sky."[198] In accounts of these visits, the report always ends with a thank-you addressed from Zeiss to the group in question: "And we in Jena thank the guests from Chemnitz for experiencing the wonder of the heavens with us, and we hope we see them soon;" or "It was wonderful to see the union enjoy stargazing with us under the dome, and hope they return again."[199] The tone of these accounts fosters a sense of camaraderie; the planetarium acts as a clubhouse playing host to a visiting group of friends.

Another group of memorable visitors was preserved in company records as charmingly astounded locals, who trundled in from the countryside to see this incredible machine and uttered delightful provincialisms in their amazement. These are usually relayed as anecdotal jokes, with no names or specific identifying details, published in the company newsletter, or circulated in internal memos. For example, an octogenarian grandmother, for example visits the Jena planetarium with her daughter:

> Inside the dome, it grows darker, ever darker. The sun gives only the faintest light, so that even planets [i.e., Mercury and Venus] that are up during the day can be easily seen. The sun and planets move along their path. The sun sets. Twilight sets in, and then, all of the sudden, it is pitch-black night, and a thousand heavenly lights, the stars, greet those below. Then the Grandmother whispers loudly to her daughter: "Oh look! Look! How marvelous! They've removed the whole roof!"[200]

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[198] Ibid.
[199] Ibid.
[200] "Kleine Begebenheiten um das Zeiss-Planetarium," brochure, no date, Sig. 61466, Carl Zeiss Archive. Though undated, the brochure is in an archive folder with other material from 1927-1930, so it seems safe to assume this is a contemporary document.

In another story, a man from rural Switzerland comes to Jena to see if the planetarium really is as wondrous as has been promised:

> […] as the presenter begins to explain: "And now has the rotation of the Earth begun," the guest sprang up out of his seat and loudly exclaimed: "What?! The Earth rotates? This is completely new to me!" The good man had, as it later came out, somehow never heard of the rotation of the earth, and of its path around the sun. And at the end of the lecture, highly satisfied, the man came up to the lecturer and proclaimed: "In this short hour I have experienced more and learned more, of the things that take place up in space, than I could in a year's worth of reading and learning from the thickest books."[201]

The butts of these jokes are always older, provincial men and women, whose basic knowledge of science, and astronomy in particular, is so lacking that the operation of the Zeiss planetarium seems to be genuinely astonishing, even frightening. The joke is that *of course* any well-educated, rational adult would recognize the illusion at work in the planetarium, and could appreciate instead on a higher intellectual and aesthetic level, while the simple farmers and grandmothers can only be amazed.

This strain of humor is curious in contrast to another genre of visitor experience that Zeiss also liked to collect and repackage in promotional materials and internal reports, namely scientists or other learned men who pronounced themselves delighted and astonished at the level of verisimilitude created by the planetarium. In a 1927 internal memo, a Zeiss employee has collected a number of testimonials of respected scientists who have come to Jena and left astounded by representational powers of the machine. Dr. Aitken of Lick Observatory, for example, reports that "the Zeiss Planetarium is the most remarkable instrument that has ever been devised to exhibit impressively, and with the

[201] Ibid.

illusion of reality, the motions of the heavenly bodies."[202] The librarian of the British Astronomical Association, Alfred Parr, writes that "So faithfully are the constellations reproduced on the dome of the building that when the space is appropriately darkened the illusion of being under the actual vault of heavens is complete."[203]

Both the scientists and the country bumpkins share feelings of astonishment and delight, but while the amazement of the provincial, uneducated visitors is the butt of the joke, the scientists' feelings are presented as proof of the planetarium's effectiveness. The sheer number of scientist testimonials that have survived within the Zeiss archives is noteworthy; Zeiss record-keepers appear to have obsessively collected any note of endorsement by any scientist who came to witness "the Wonder of Jena." There are an especially large number of international scientist testimonials preserved in the archives.

Many of these international reviews of the planetarium by visiting scientists were also calls and pleas to their home cities to build a planetarium as well. Clyde Fisher, head of the American Museum of Natural History, wrote that he was "enthusiastically in favor of securing a Zeiss Projection Planetarium […] May the first one [in America] come to the American Museum of Natural History!"[204] A letter by Dr. J. Jackson, vice-director of the Greenwich Observatory, to the editors of *The Times of London*, lays out a case for London's acquisition of a planetarium. "The value of the planetarium," he writes, "can hardly be exaggerated. […] As one of the very few British astronomers who have seen a Planetarium in operation, I have not the slightest doubt that when one is erected in London it will prove

[202] Untitled internal memo, 1927, ASTRO 0373, Carl Zeiss Archive.
[203] Ibid.
[204] See footnote 70.

an enormous attraction to all members of the community."[205] Jackson's letter to *The Times* has been saved in the archives not as a newspaper clipping, but as a typed-out copy on Zeiss company letterhead, and many of the other collections of testimonies have been similarly preserved. The careful collection and preservation of positive international testimony points to a concern at Zeiss about the perception of its machine in international circles, and to an effort by Zeiss to market the planetarium explicitly to cities abroad.

This international focus is especially clear when we consider the fourth general category of visitors and correspondence: the foreign diplomats, state officials, and noteworthy individuals who came to the Jena planetarium, and the visits representatives of Zeiss payed to officials abroad. In 1928, for example, the "diplomatic corps [i.e. all the international ambassadors to Berlin] as a whole made the trip from Berlin to Jena to view it and the great works where it is produced."[206] Over the years, other notable visitors included the King of Siam, Henry Ford, and Max Adler (who later purchased a planetarium for Chicago. An English-language brochure from the early 1930s proclaims "Why Not Include a Visit to a Zeiss Planetarium on Your European Trip?"[207] [*Figure 3.19*] "This stellar fairy-land," the text continues, is "one of the wonders of the world. Don't fail to see it!"[208] These efforts established Jena as a must-see destination for any travelers moving through Europe, and established Zeiss as a reliable source of impressive technology and wonder. [*Figure 3.20*]

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[205] J. Jackson, "Astronomy by the new invention: A SUGGESTION FOR LONDON: To the Editor of The Times," *The Times* (20 December 1926).
[206] Franz Fiesler, *The Zeiss Planetarium, its genesis, and its cultural value*, no date, ASTRO 910, Carl Zeiss Archive.
[207] Brochure, no date, ASTRO 0288, Carl Zeiss Archive.
[208] Ibid.

During these early years, from 1926 into the early 1930s, Zeiss was also aggressive about sending representatives abroad to sell projectors to cities that that might be interested. Franz Fieseler, a representative of the planetarium division at Zeiss, regularly made trips throughout Europe and, later, the United States, to sell the planetarium. In May 1928, he visited Mussolini, who was reportedly so enchanted that he ordered a projector immediately, and in October, a planetarium opened in an ancient Roman bathhouse, near the center of the city.[209] Not all forays were so successful, however. The case of the failed Copenhagen planetarium offers a useful case study for a consideration of the lengths to which Zeiss was prepared to go to establish planetaria abroad.

When Elis Strömgren came to visit the prototype planetarium on the roof of Building 11 in 1924, and subsequently coined the name "Wonder of Jena" in his review of the apparatus, he also called for Copenhagen to install one as quickly as possible, and, using his position as director of the Royal Danish Observatory, began to campaign heavily to the city. He appears to have begun this effort as early as the fall of 1924, only a few months after his visit, and even before his review was published in *Politiken*. In September, Zeiss retained a business law firm, Brock and Michelson, in Copenhagen, to serve as their representatives in Denmark, and the firm kept Zeiss regularly apprised of their and Strömgren's combined efforts. In October, Brock and Michelson wrote with bad news: Strömgren's idea, to engage the Danish consul, had not gone well. Furthermore, his attempts to convince the Copenhagen school board of the need for a planetarium for school children, had also fallen on deaf ears. What really needed to happen, in their opinion, was

[209] Letter from Carl Zeiss Jena to Carl Zeiss Berlin, 11 May 1927. BACZ 3100, Carl Zeiss Archive.

"for these men to see the planetarium in person, and then they would understand."[210] But since no official of Copenhagen felt inclined to make the trip down to Jena, this avenue, too, was closed.

For the next seven years, Zeiss maintained a constant correspondence campaign to win over the city officials of Copenhagen, with Brock and Michelsen as intermediaries, and with Strömgren as a constant voice of support. In June 1928, they sent a thick file of copied-out newspaper articles praising the Zeiss planetaria installed in Hannover, Rome, Vienna, and Stuttgart. This went unanswered for several months, but in October 1928, Brock and Michelson wrote with slightly better news. The city council was slowly coming around to the idea of a Copenhagen planetarium, but still felt some reserve about a machine they perceived to be of limited use. If Zeiss could show that the planetarium could serve other purposes besides its primary one, perhaps, suggest Brock and Michelson, the council might change its mind. Franz Fieseler wrote back in May of the following year with assurances that the planetarium building could serve many uses, including a concert hall, a lecture hall, and even a cinema. This last promise was accompanied by a list of successful film screenings in the recently installed Hannover planetarium, which had hosted nineteen films from October 1928 to May 1929, including Ufa's 1920 expressionist hit, "The Cabinet of Dr. Caligari."[211] At the same time, Fieseler sent a news clipping from a Swedish newspaper announcing the opening of the Stockholm planetarium, which proudly

[210] Brock and Michelson (Copenhagen) to Carl Zeiss Jena, 31 October 1924, BACZ 3075, Carl Zeiss Archive.
[211] Franz Fieseler (Carl Zeiss Jena) to City Council (Copenhagen), 15 May 1929, BACZ 3075, Carl Zeiss Archive. Hannover seems to be the planetarium with the most film screenings to its name, though Berlin and Hamburg both reportedly screened several documentaries. Curiously, there is no extant discussion, at least that I have found, about *how* these films were screened in the planetaria without the image being unwatchably distorted on the dome. This does not seem to have been a popular secondary use of the space, but Zeiss regularly promises interested parties that the building can serve this purpose.

announced that Stockholm had secured the covetous title of "first planetarium in Scandanavia."[212]

Still, Copenhagen remained unmoved. The correspondence slowed, though the Zeiss record-keeper carefully preserved a September 1930 article from *Politiken* which asked, "Was the Copenhagen planetarium sabotaged?" and concluded that since Zeiss had jumped over every hurdle and satisfied every demand of the Copenhagen planetarium committee, to no avail, there must have been some insider financial dealings that the purchase and installation of the planetarium would somehow have disrupted.[213] Whether or not the Copenhagen planetarium was deliberately sabotaged, the ordeal is a useful case study for how eager and willing Zeiss was to spread its planetaria abroad. Copenhagen is a notable failure; Zeiss was far more successful in other cities, and by 1933 had planetaria in Rome, Den Haag, Moscow, Stockholm, Philadelphia, Chicago, and Vienna, with others planned for Los Angeles, Pittsburgh, Tokyo, Osaka, Paris, and Brussels.

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In one of the charming planetarium anecdotes that circulated in internal memos through Zeiss, a farmer eagerly buys an entry ticket, exclaiming to the cashier that he is excited to learn "all about everything."[214] At the end of the show, he returns to the ticket counter to proclaim that "I'm just a humble farmer, but please do tell Mr. Zeiss how completely wonderful it is inside. German technology is so magnificent, and even though we lost the war, it doesn't mean anything. If any man were to look inside and see that

[212] Carl Zeiss Jena to Brock and Michelson (Copenhagen), 29 April 1929, BACZ 3075, Carl Zeiss Archive.
[213] "Wird das Planetarium sabotiert?" *Politiken* (4 September 1930), BACZ 3075, Carl Zeiss Archive.
[214] "Kleine Begebenheiten um das Zeiss-Planetarium"

marvelous thing, he'd be completely convinced that Germany will rise again."[215] This anecdote echoes the poem by irate visitor Bodo Grützner, above, expressing his indignation regarding the latinate naming convention of "planetarium," which, in his mind, did a disservice to the German origins of the machine. There is an awareness in both of these, as there is in Zeiss's decision to preserve and publish them, that the Germanness of the planetarium is one of its most appealing features to the German audiences.

Zeiss was aware of this appeal, as much as it also tried to position the planetarium as an internationally appealing machine, that every city ought to have. Though Zeiss recognized early that the planetarium would never be a major source of revenue, even during the lean years of the early 1920s, Villiger and others on his planetarium team saw the it as a good-will ambassador of sorts, an example of German technology put toward beauty and wonder, rather than war. Zeiss thus engaged in a careful balance of advertising the planetarium abroad as a universally appealing machine, while also acknowledging that a significant part of its draw within Germany was as a specifically German invention.

This awareness is especially telling in light of Jena's, and Thuringia's, increasing turn to the reactionary right during the mid-1920s, after the federal dissolution of Thuringia's short-lived Communist-Socialist coalition government in 1923. This shift resonated in several registers. For one, the increasingly right-leaning government cut its funding to the Bauhaus school, prompting Gropius and his fellow members to move the school to Dessau, in Saxony-Anhalt. While the Kunstverein continued to host exhibitions into the 1920s, it too felt the increasingly conservative restrictions of government support,

[215] Ibid.

and the modernist moment in Jena faded. The conservative turn was so pronounced by 1930 that Thurinigia became the first state to elect a Nazi party official to the governing coalition; Wilhelm Frick, who was notoriously anti-modernist, became the interior and culture minister in 1930, until the coalition was defeated in 1931. Zeiss was well aware of this shift, and as we shall see in the fourth and final chapter, developed an uneasy, and at times unstable, relationship with the increasingly far-right government. Zeiss's encouragement of the nationalist base of planetarium admiration was not inconsistent with its history of support for modernist artistic communities or its international ambitions; rather it points again to the company's constant awareness of its position in the cultural legacy of Jena.

Zeiss saw the planetarium as a significant part of its vision for Jena, as a place in which the city's romantic intellectual tradition and its newer scientific legacy productively coexisted. The sensations of wonder and amazement the planetarium produced were part of a romantic cultural heritage stretching back to Goethe. Often this link was made explicitly clear within the planetarium itself. In an undated draft of a proposed lecture in the Jena planetarium, for example, the show opens with a series of excerpts from Goethe's poetry. From *Faust*'s prologue, Gabriel speaks:

> And swift, and swift beyond conceiving,
> The splendor of the world goes round,
> Day's Eden-brightness still relieving
> The awful Night's intense profound.[216]

[216] Original text in "Geeignete Zitate fur Planetariums-Vortraege," no date, BACZ 16096, Carl Zeiss Archive. Translation from Bayard Taylor translation. This presentation draft also includes excerpts from Goethe's *Trost in Traenen*, as well as Nietzsche's *Also spräch Zarathustra*.

The intentional, repeated reference to Goethe and other figures of the romantic tradition is indicative of Zeiss's awareness of the planetarium as a machine carrying intellectual and cultural weight. In the next chapter, I will explore these connections further through a close study of the planetarium in Berlin.

Chapter III: "Zum Planetarium"
Berlin and *Heimat*

The Berlin Planetarium opened its doors on the night of 27 November 1926, to the tune of Schubert's Quartet in C Major. Lacking a traditional stage, the musicians sat in the middle of the Planetarium's 25m-wide dome, arranged in a half-moon around the star of the evening's festivities: the hulking, 4m-high Zeiss Mark II projector. Shaped like a massive dumbbell and mounted on a raised dais, it dwarfed the audience of several hundred who came to celebrate its installation. [*Figure 4.1*] The list of speakers was impressive: the mayor, Gustav Böß (1873–1946); city councilman Wilhelm Benecke (1883–1962); and, finally, the inventor of the planetarium himself, Dr. Walther Bauersfeld (1879–1959).[217] A film camera recorded the entire event; the shots pan over the crowd milling around the entrance, linger on Böß and Bauersfeld watching the doors open for the first time, and rest at last on the image of the immense planetarium projector itself as it slowly rotates, its projected stars lazily moving across the artificial sky of the dome.[218]

For all the fanfare of its opening ceremony, the Weimar-era Berlin planetarium has faded into relative obscurity. This is due partly to the lack of materials from its years of operation; almost all of the administrative records and institutional archives were destroyed along with the planetarium itself in the 1943 bombing that decimated most of the Zoological Garden and the Kaiser Wilhelm Memorial Church. Much of what survived was held at the Carl Zeiss Optical Company headquarters in Jena in the form of reports that the directors of the planetarium sent back to the company, but a majority of that material was

[217] "Planetarium der Stadt Berlin. Programm zur Eröffnung," 27 November 1926, Carl Zeiss Archive, BACZ 3100.
[218] "Science's Latest Wonder," British Pathé, 1926.

lost during the company's split and re-merger during and after the Cold War. What has survived these ruptures is a patchwork of bureaucratic records and institutional correspondence, primarily from the late 1920s and early 1930s. Nonetheless, reading these documents alongside contemporary newspapers, feuilletons, and cultural essays produces a picture of the Berlin planetarium as a significant part of the city landscape.

In the vast historiography of Weimar-era Berlin, historians have approached the city through an array of different mediums: architecture, print culture, film, cabaret, maps, theater, literature, and others.[219] Most elements of Berlin life, from entertainment to work to consumption to production, have been thoroughly unpacked, and yet the planetarium rarely, if ever, appears. Nonetheless, during its fifteen years of operation, it received millions of visitors, hosted concerts and films alongside hundreds of astronomical presentations, and attracted the attention of a wide array of persons and institutions, from Walter Benjamin in 1928 to Henry Ford in 1930 to officers of the Luftwaffe in 1936. In this chapter, I argue that the planetarium served a dual role in Weimar Berlin – first, it was a place in which spectacular technological modernity intersected with new forms of scientific pedagogy to create uniquely urban site of education and entertainment; and second, that it was a place of refuge against the overstimulation of the city, in which visitors

[219] A sampling of such histories of Berlin include Peter Jelavich, *Berlin Cabaret* (Cambridge: Cambridge University Press,1993); Peter Fritzsche, *Reading Berlin 1900* (Cambridge, MA: Harvard University Press, 1996); Hermann Bausinger and Theodor Kohlmann (ed.), *Großstadt. Aspekte empirischer Kulturforschung* (Berlin: Staatliche Museen Preußischer Kulturbezitz, 1985); Michael Bienert and Elke L. Buchholz, *Die Zwanziger Jahre in Berlin. Ein Wegweiser durch die Stadt* (Berlin: Berlin Story Verlag, 2005); Andreas Killen, *Berlin Electropolis. Shock, Nerves, and German Modernity* (Berkeley: University of California Press, 2006); Eric D. Weitz, *Weimar Germany. Promise and Tragedy* (Princeton: Princeton University Press, 2007); Sabine Hake, *Topographies of Class. Modern Architecture and Mass Society in Weimar Berlin* (Ann Arbor: University of Michigan Press, 2008); and Frances Mossop, *Mapping Berlin. Representations of Space in the Weimar Feuilleton* (Bern: Peter Lang Verlag, 2015).

could find an artificial reconstruction of a pre-modern night sky, free of noise and lights, peaceful in a way the bustling metropolis could never be.

Most studies of Weimar Berlin begin with the same observation: that by the end of the nineteenth century, Berlin had completely transformed itself into the quintessential modern city; an influx of scientific industries in the late nineteenth century, combined with the flourishing of modernist culture in the early twentieth made Berlin an essential cultural and intellectual center. This transformation and embrace of the modern was accompanied by an increasing anxiety about the negative side effects of over-stimulation, and a rising disgust among a conservative population about the degenerate and out-of-touch "spirit of Berlin."[220]

Nonetheless, Berlin in the middle of the Weimar Republic – after the currency stabilization and before the insistent press of fascism – was a city oriented towards the future. In particular, the technological dimension of this forward-looking attitude was situated around various sites of spectacle built on modern scientific and technological knowledge – sites like the scientific theater of the Urania in Mitte and the rocket testing sites up in Tegel, but also places like the Zoological Garden in Charlottenburg, the cinema palaces on Nollendorfplatz and along the Kurfürstendamm, the Lunapark in Halensee, and the planetarium itself.

The planetarium, like the Urania or the rocket launches, was part of a collection of Berlin sites that engaged explicitly with the possibility of outer space. The planetarium,

[220] Ludwig Finkh, "Der Geist von Berlin," *Schwäbischer Merkur* 14 (10 January 1919). In Anton Kaes, et al., ed., *The Weimar Republic Sourcebook* (Berkeley, CA: University of California Press, 1995). This formulation is seen in slightly variations in all the texts above.

however, remains a unique case. It participated rather less with contemporary space enthusiasm, and more with contemporary anti-urban sentiments rooted in a desire to escape from the city and return to the natural countryside, free from artificial light and surrounded only by a lofty firmament of real stars. Both official planetarium literature and reflections on the planetarium from cultural critics and laypeople alike consistently reiterate its ability to take its audience out of the city, to produce the sensation of sitting out somewhere tucked away from the blinding brilliance of urban life. This displacement was understood to be not just pleasant, but vital – a necessary recalibration of human psyches damaged and unsettled by the modern urban landscape.

The Berlin planetarium as a case study therefore offers an example of an astrocultural site that looks not just forward, but also back - a place that uses the imagery of outer space not just to excite and titillate, but also to support a fantasy about a return to a pre-modern communal life in the German countryside. To this end, I draw from a body of literature inspired by Jeffrey Herf's 1984 study of reactionary Weimar modernists who both rejected Enlightenment reason and embraced technology.[221] Several works since have revisited this thesis, refined it, and expanded it.[222] This literature tends to focus specifically on the reactionary modernism of the Third Reich, but I find Michael Allen's study of the discourse of *Volk* among SS engineers to be particularly useful here, for its demonstration of how this reactionary modernism was oriented around community formation.

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[221] Jeffrey Herf, *Reactionary Modernism. Technology, Culture, and Politics in Weimar and the Third Reich* (Cambridge: Cambridge University Press, 1984).

[222] See Mark Walker and Monika Renneberg (eds.), *Science, Technology, and National Socialism* (Cambridge: Cambridge University Press, 1995); Michael Allen and Gabrielle Hecht (eds.), *Technologies of Power. Essays in Honor of Thomas Park Hughes and Agatha Chipley Hughes* (Cambridge, MA: Harvard University Press, 2001); John Guse, "Nazi Technical Thought Revisited," *History and Technology* 26 (March 2010), 3–38.

In thinking about the construction of a countryside fantasy within the planetarium dome, I am influenced by work on the concept of *Heimat* and German nature as it developed through the Weimar Republic.[223] *Heimat*, and the local *Heimat* movements that revived themselves after the end of the First World War, was not an explicitly anti-modern concept, but it was articulated, nonetheless, as a desire to move away from city centers and back to the nation's natural roots. It was also, in this period, tied up intimately with strengthening nationalist rhetoric, in which *Heimat* was understood as a specifically German tradition. It is cliché at this point to note that Weimar Berlin was characterized by a tension between modern enthusiasm and a reactionary anti-modernism, but the aim of the present study is to explore how the planetarium gave this tension a specific spatial dimension, and became a site in which technological wizardry worked to produce a sense of naturalism. In what follows, I first provide a short history of the planetarium's installation in Berlin, followed by a description of a typical visit to the planetarium during the early years of its operation. I then examine several of the most popular performances from these years, and I consider the planetarium within the context of science education and entertainment in Berlin. Finally, I explore the conflicting rhetorics of space, technology, and modernity that inhabited the planetarium's operation.

By 1933, there were eleven planetaria in Germany alone, receiving in total more than three million visitors, and half a dozen more planetaria were being installed around

[223] See Celia Applegate, "The Question of *Heimat* in the Weimar Republic," *New Formations* 17 (1992), 64–74; Thomas M. Lekan, *Imagining the Nation in Nature. Landscape Preservation and German Identity, 1885–1945* (Cambridge, MA: Harvard University Press, 2004); David Nye, ed., *Technologies of Landscape. From Reaping to Recycling* (Cambridge, MA: Harvard University Press, 1999); David Blackbourn, *The Concept of Nature: Water, Landscape, and the Making of Modern Germany,* (New York: W.W. Norton and Co, 2006); Claus-Christian W. Szejnmann and Maiken Umbach (ed.), *Heimat, Region, and Empire. Spacial Identities under National Socialism* (London: Palgrave Macmillan, 2012).

the world.[224] The Berlin planetarium was the sixth to open in 1926, after Düsseldorf, Barmen, Dresden, Leipzig, and Jena. Most of them opened within eight weeks of each other during the early summer, while the Berlin planetarium was inaugurated in November. The rapid installation of these planetaria speaks to their broad appeal in this moment, as well as to the Zeiss company's aggressive – and largely successful – marketing campaign that targeted major metropolitan centers. In the letters and telegrams Zeiss representatives exchanged with tentatively interested city administrators across Germany, praising the virtues and variability of the planetarium, they paint the planetarium as an essentially modern creation, an experience that fits seamlessly into the modern metropolitan landscape.[225] Nowhere were these qualities more extolled than in Berlin.

The planetarium appeared at the resolution of two related transformations that occurred at the end of the long nineteenth century. The first was a rapidly growing enthusiasm for popularly accessible science, especially after the massive midcentury popularity of Alexander von Humboldt's *Kosmos*. This enthusiasm was fed by an increasing number of professional science institutions - museums, scientific theaters, lecture series, etc. – whose primary goal was public education. These institutions included the Urania in Berlin, which opened as a science theater in 1888 and offered dramatically performed scientific lectures.[226] In many ways, the planetarium stands as the inheritor to

[224] Internal memo, n.d. (probably 1933), Carl Zeiss Archive, BACZ 2259.
[225] Franz Fieseler, *Das Zeiss-Planetarium, seine Entstehung und kulturelle Bedeutung*, 1936, Carl Zeiss Archive, ASTRO 910.
[226] For more on the history of science education and popularization in Germany during the nineteenth century, see Andreas W. Daum, *Wissenschaftpopularisierung im 19. Jahrhundert. Bürgerliche Kultur, naturwissenschaftliche Bildung und die deutsche Öffentlichkeit, 1848–1914*, (Munich: Wilhelm Fink Verlag, 2002). For more on the rise of popular science in the nineteenth century, see Bernard Lightman and Aileen Fyfe, *Science in the Marketplace. Nineteenth-century Sites and Experiences*, (Chicago: Chicago University Press, 2007.

the projects of public science education of the nineteenth century, but what it offered to Weimar audiences diverges significantly from the model perfected in the *fin de siècle*.

The second major shift in which the planetarium must be contextualized was Berlin's transformation into a major cosmopolitan center. In 1888, at the opening of the Urania, the city hosted close to one and a half million people, but by 1927, when the planetarium opened its doors, that number had risen to over four million. This shift in population was one of several transformations in this period. Berlin at the end of the nineteenth century was a city characterized by its embrace of science and industry — it was the home of Siemens and AEG, as well as a number of science institutions like the Kaiser-Wilhelm-Institutes, and science education centers like the Urania. As Martina Hessler has argued, the "first decades of Berlin's 'modernity' were defined […] by science and technology."[227] In the first decades of the twentieth century, however, the character of the city shifted from one defined primarily by its technological modernity to one in which modernity was increasingly an aesthetic and cultural category.[228] Thus the Berlin planetarium, while in some ways an inheritor to the same concerns that drove the founding of the Urania and other popular science societies at the turn of the century, was nonetheless situated at the center of a significantly different city. Of the eleven planetaria that were operating in Germany by 1933, Berlin's was by far the most heavily trafficked. Attendance records estimated an average of 775 visitors per day, compared to 229 in Jena, at the Zeiss

[227] Martina Hessler, "Berlin's Culture of Change Around 1900," *in Urban Modernity. Cultural Innovation in the Second Industrial Revolution*, ed. Miriam R. Levin, Sophie Forgan et al. (Cambridge, MA: Harvard University Press, 2010), 168.
[228] Ibid.

company's flagship planetarium.[229] This discrepancy was in large part due to the clever positioning of the planetarium within the ever-expanding geography of Berlin during the Weimar Republic.

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A visitor to the Berlin planetarium would usually arrive by train, disembarking at the Zoological Garden station. The Zoo station originally opened in 1882 for local trains, and in 1902 it expanded to include one of the first underground subway stops. It was the major transit hub of the western side of the city, and the city planners took this into account when choosing a location for the planetarium. "This place was chosen," read the promotional brochure, "because of the exceptionally favorable transportation possibilities. […] It was also the desire of the city administration to place the planetarium in a context where, year after year, tourists and locals alike will return. This is the case with the Zoo."[230] [*Figures 4.2 and 4.3*] This makes clear the desire at the institutional level for the planetarium to be perceived not simply as an educational experience, or as part of a larger museological framework devoted to science education for the masses. Rather, the Berlin planetarium was intended to be viewed as a tourist attraction as well.

The location of planetaria in the Weimar period varied from central city plots to more remote sites. A similarly metropolitan vision informed the installation of the planetarium in the Leipzig Zoo. "We assumed," reads the brochure, "that visitors to the Zoo would already be drawn to the beauty of the natural sciences, and so would be likewise

[229] Untitled internal report, 1933, Carl Zeiss Archive, BACZ 3100.
[230] *Planetarium der Stadt Berlin*, p. 8.

drawn to the Planetarium."[231] In contrast, the Hamburg planetarium stands alone in the middle of a vast park. Installed in the top floor of a magnificent water tower, it is significantly grander than some of its counterparts. [*Figure 4.4*] Originally, local officials feared the planetarium would be far too remote. As an article in the *Hamburger Correspondent* wrote in 1931, "many consider the planetarium inconvenient because it is far removed from all major transport centers, and even the nearest trains and trams are ten minutes away. In the winter months, the unpaved park lanes and lack of lighting are a serious problem. The lack of any roads or parking spaces for cars will be an issue in the long run as well." Nonetheless, they continue, "for contemplative visitors, for true friends of astronomy and stargazing, the location in the park is absolutely ideal. You step out of the planetarium and come out under the natural starry sky, and can allow all the effects of the planetarium show to reverberate within you."[232]

In each of these cases, the location of the planetarium offers a glimpse into how city officials imagined the planetarium would be used – as both a site of refuge, a breath of fresh air away from the confining noise of the city, or thrust into the middle of the cacophony of impressions that make up the metropolitan landscape.

Upon exiting the train station on Joachimsthalerstraße, the visitor to the Berlin planetarium would face the main entrance of the Zoo, with the famous domed roof of the Elephant House peering behind the entrance gate. [*Figure 4.5*] To the immediate right stood the magnificent Ufa-Palasta, which in 1926 was the largest cinema in the country.

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[231] *Planetarium im Leipziger Zoo* (1927), 7.
[232] "108511 Hamburger sehen zu den Sternen empor: Die erste Bilanz des Planetariums — Neue Pläne und Vortäge für 1931," *Hamburger Correspondent* (1 April, 1931).

Past the Ufa-Palast, they could glimpse the spire of the Kaiser Wilhelm Memorial Church rising over the beginning of the Kurfürstendamm. To the left, the planetarium itself sat at the corner of Kurfürstenallee. [*Figure 4.6*] The visitors could arrive at the planetarium in one of two ways; they could either walk up the street to the corner, where the planetarium sat nestled in a small copse of trees, or they could pay an additional one Reichsmark admission fee and walk first through the Zoo.

The planetarium sat on its own small plot of land, and charged an admission of one Reichsmark for adults, and fifty pfennigs for students and children.[233] It was a small building, comprised mostly of the twenty-five-meter-wide dome and an entrance hall. Richard Ermisch (1885–1960), a *Baurat* in the Berlin municipal construction office, was the chief architect. Planetaria posed a unique challenge for architects of this period; the most pressing concern was the construction of a dome that was large and stable but also perfectly smooth, so as to fade as easily as possible into the background when the projector was turned on. The dome engineered by the Zeiss company, and adopted by Berlin, was essentially an expandable steel net which was pushed and pulled open by men climbing on the dome as it grew.[234] The images of the dome construction in Berlin are striking and suggestive: an enormous, arching net, with a dozen workers clinging to the underside, "a group of men who move in a technically organized space between Heaven and Earth, producing an image that looks like a stellar constellation."[235] [*Figure 4.7*] When the dome

[233] The Zoo's admission price in this period was the same, as was the Aquarium's.
[234] Joachim Krausse, "Architektur aus dem Geist der Projektion. Das Zeiss-Planetarium," *Wissen in Bewegung. 80 Jahre Zeiss-Planetarium Jena*, (Jena: Ernst Abbe Stiftung, 2006), 67.
[235] Hans-Christian von Herrmann, "Die bestirnte Himmel über mir… Das Projektionsplanetarium in der Wiesenkultur der Moderne," in *Astroculture. Figurations of Cosmology in Media and Arts*, ed. Sonja Neef (Munich: Wilhelm Fink Verlag, 2014), 110.

was stabilized and soundproofed, the interior was covered entirely in smooth white canvas. The resulting space was cavernous and entirely featureless, its emptiness interrupted only by the looming presence of the projector itself. The rest of the building was strikingly simple. Ermisch built a small foyer to house all the operational necessities – the director's office, a coatroom, toilets, and a ticket kiosk – but hardly any ornamentation. The only decorative elements stood above the entranceway, as noted in a promotional pamphlet on the planetarium's design:

> The exposed surfaces of the building attained, with a look toward the stone veneers of the surrounding buildings, a cladding of reddish-brown bricks; as the only ornaments, ceramics were affixed to the main facade, which – on the fascia – represent the night sky and – above the entrances – bear the astronomical signs of the days of the week.[236]

Visitors to the planetarium would have little cause to linger in the plain entrance hall any longer than it would take to hang their coats, proceeding instead into the darkened space of the dome. Settled in their seats, they were asked to close their eyes in the silence, and imagine themselves on "a starry night, on a peak somewhere in the Alps," as the houselights dimmed and the projector hummed to life.[237]

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The planetarium in Weimar Berlin operated in a space between scientific pedagogy and spectacular entertainment, a balance that had previously been developed in other spaces of education and performance, such as the Urania. In this respect, it is remarkably similar to its neighbor, the Zoo, which had always been a center of leisure mixed with

[236] *Das Planetarium der Stadt Berlin*, p. 11.
[237] Quoted in Alison Griffiths, *Shivers Down Your Spine. Cinema, Museums, and the Immersive View* (New York: Columbia University Press, 2008), 129.

education. Though it was Prussia's first official zoological garden, it was not the first collection of animals on display in Berlin; it had predecessors in various traveling menageries that would pitch their tents underneath the Brandenburg Gate. However, it was the first to combine the spectacle of exotic animals with a scientific approach to their presentation.

A history of the Zoo published in 1929 argued that the early Zoo guidebooks for visitors, which contained descriptions of the animals and histories of their habitats and lives, provided an "illuminating look into that new science, which at the time was first called natural history."[238] The Zoo thus presented the animals in two different ways simultaneously: from one perspective, they were objects of scientific consideration, with natural histories and biological facts; on the other, they were objects of spectacular exoticism, displayed in elaborately staged environments. As Oliver Hochadel and others have shown, zoos at the end of the nineteenth century were both sites of entertainment for the lay public and of education and scientific research; the zoo was thus both a social and public space, and an academically-oriented research environment.[239]

The Berlin Zoo in this period was one of the first zoos to introduce naturalist environments for the animals, a change that Gary Bruce attributes to an expansion of its intended purpose, from a scientific catalog of physiological variety in the animal kingdom, to a broader display of animals living, even thriving, in their natural habitats.[240] The

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[238] Adolf Heilborn, *Zoo Berlin 1841–1929. Zur Geschichte des Zoologischen Gartens zu Berlin,* (Berlin: Gebrüder Jacob Verlag, 1929), 8.
[239] See Oliver Hochadel, "Watching Animals Next Door. "Scientific" Observation at the Zoo (ca. 1870–1910)," *Science in Context* 24 (2011), 183–214.
[240] Gary Bruce, *Through the Lion Gate. A History of the Berlin Zoo* (Oxford: Oxford University Press, 2017).

European brown bears, for example, were housed in a sunken pit with large leafless trees reaching up to the main level of the zoo, on which they could climb and come face to face with the visitors behind the fence. The elephants were housed in the spectacular Elephant House, whose design was loosely based on the architecture of southeast Asian palaces, while the four African ostriches lived in a beautiful pastiche of Egyptian temples, with hieroglyphs so accurate Egyptology students from the Humboldt University would come to study them.[241] The peacocks lived in an elaborate aviary in the northeast corner of the park, next to the planetarium. The habitats drew on fantasies of distant continents: the orientalist facades speak to an attempt to bring the far-flung exotic corners of the world into Berlin, for observation and consumption.

This was especially true for the human zoo exhibits, whose popularity had waned in the war years and early tumultuous years of the republic, but which were once again on the rise in the mid-1920s. A wildly successful traveling troupe of Bedouins from Tripoli opened at the Zoo only a few weeks before the planetarium opened, attracting tens of thousands of visitors a day.[242] The planetarium, and its promise to show its audience not just the skies at home, but also skies abroad, was thus in good company. I draw this comparison not just to highlight the similarities in the travel fantasies of the zoo and those promoted in some of the planetarium shows, but also to suggest that the planetarium be understood as a similar kind of space that balanced both entertainment and spectacle, and scientific education for a curious lay public.

[241] Ibid., p. 100.
[242] Ibid, p. 139.

The planetarium's most obvious astronomical predecessor in Berlin is the Urania, which was founded in 1888 through a collaboration between the astronomer Wilhelm Foerster and the popular astronomy lecturer Max Wilhelm Meyer. Foerster had originally envisioned a public observatory built on a large tract of land donated by the Prussian state, but the project had been dismissed because the weather in Berlin was notoriously unreliable. Operating an observatory was also expensive and cumbersome, and Foerster struggled to find financial support. Meyer proposed combining the public observatory with his own astronomical "dramatic lecture," which he had perfected in Austria and had recently brought to Berlin. The result of this collaboration was the Urania building, which housed a 4.3m refracting telescope as well as the large, ornate "scientific theater" which housed Meyer's astronomical *Schauspiel*.[243] [*Figure 4.8*]

The model of an entertaining scientific lecture on which Foerster and Meyer were drawing was rooted in the widespread popularity several decades earlier of Alexander von Humboldt's *Kosmos*, which Humboldt published as a five-volume study of the natural world. *Kosmos* was originally conceived as a series of lectures on physical geography, which he first gave at the Berlin University beginning in November 1827. The lectures were so immensely popular that he announced a parallel performance at the Singakademie, free to the whole public. The lectures sought to describe "a picture of the entire natural world," a universal cosmology that incorporated chemistry, biology, geology, and

[243] For more on this collaboration, see Ole Molvig, "The Berlin Urania, Humboldtian Cosmology, and the Public," in *The Heavens on Earth: Observatories and Astronomy in Nineteenth-Century Science and Culture*, ed. David Aubin, Charlotte Bigg, and H. Otto Sibum (Durham, NC: Duke University Press, 2010,) 330. For More on the Urania's intellectual projects, see *Von den Sternen auf die Erde: 110 Jahre Urania: eine Festschrift* (Berlin: Urania, 1998).

astronomy.[244] Humboldt himself was drawing on a longer eighteenth-century tradition of public science lectures, but his were unique by virtue of their sheer scope, their free availability, and their theatric delivery. Humboldt's Berlin lectures were the first articulation of a growing German preoccupation with popular science during the nineteenth century. This interest resulted in an increase of public lectures following Humboldt's new, dramatic model, as well as a rise in educational institutes and natural history museums. The Berlin natural history museum, for example, facing a marked increase in public interest, began the construction of a new and larger building for its collections simultaneously with the construction of the Urania. Martina Hessler has argued that this effort was "intended to educate people and to spread a bourgeois culture that was closely connected with earlier movements for the popularization of science."[245]

The Urania was explicitly part of this movement, designed to attract a broadly educated middle-class audience for a respectable but entertaining education.[246] What differentiates the Urania from many of its predecessors was the literal dramatization that Meyer added by staging the lectures in a theatrical space built specifically for that purpose, complete with set pieces, musical accompaniment, and the most advanced lighting technology of the time.[247] The Urania, with its technologically flashy, dramatically educational performances, can therefore be understood as a prominent precursor to the planetarium.

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[244] Daum, 271.
[245] Hessler, 173.
[246] Molvig, 330.
[247] Arne Hessenbruch, "Science as Public Sphere: X-Rays Between Spiritualism and Physics," in *Wissenschaft und Öffentlichkeit in Berlin, 1870-1930,* ed. Constantin Goschler (Stuttgart: Franz Steiner Verlag, 2000), 94.

Nonetheless, while the Urania's style of theatrical pedagogy influenced the delivery of the planetarium lectures, the Urania never sought to provide an entirely immersive experience. It was still very much a theatrical space, with a clear divide between audience and lecturer. As Arne Hessenbruch has argued, the Urania "embodied in its very structural elements the distance between the scientist as professional expert and the lay audience."[248] While the Urania still had explicit connections to the active scientific community in Berlin, connected physically as it was to the observatory, the planetarium stood oddly separate. While the planetarium was educating the lay public on the basic mechanics of orbits and the challenges of scientific observation, by taking them on dizzying journeys through time and space, the Berlin scientific community was otherwise engaged. The interwar decades saw both the refinement and expansion of a new cosmology based on Einstein's theories of relativity and the development of quantum mechanics, as well as an emerging interest in rocket propulsion technologies at the rocket enthusiast societies that experimented in the north of the city. Taken together, these changes formed the early manifestations of outer space enthusiasm that would come to full expression during the Cold War.[249]

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[248] Ibid.

[249] For a recent examination of the "fools of Tegel" who experimented with rocket propulsion in the Tegel area north of Berlin, see Tillman Siebeneichner, "Die 'Narren von Tegel': Technische Innovation und ihre Inszenierung auf dem Berliner Raketenflugplatz, 1930-1934," *Technikgeschichte* 84, no. 4, 353-379. For histories of Weimar science, see Paul Forman, "Weimar Culture, Causality, and Quantum Theory, 1918–1927. Adaptation by German Physicists and Mathematicians to a Hostile Intellectual Environment," *Historical Studies in the Physical Sciences* (1971), 1–115. For more on rocket societies, see Frank Winter, *Prelude to the Space Age. The Rocket Societies, 1924–1940*, (Washington, DC: Smithsonian Institution Press, 1983), 35–44; Alexander C.T. Geppert, "Space *Personae*. Cosmopolitan Networks of Peripheral Knowledge, 1927–1957," *Journal of Modern European History* 6 (2008), 262–86; and Michael J. Neufeld, *The Rocket and the Reich. Peenemünde and the Coming of the Ballistic Missile Era,*(Cambridge, MA: Harvard University Press, 1996). There is one notable exception to the general separation of the planetarium from the scientific community, which is that during the early years of the Second World War, the Luftwaffe would often hold stellar navigation lessons in the planetarium. This will be explored more in the fourth chapter.

Historians such as Alexander Geppert and Michael Neufeld have shown that this enthusiasm peaked in 1928–29. The fad culminated with Fritz Lang's 1929 film *Frau im Mond*, which featured a rocket designed by the experimental rocket engineer Hermann Oberth (1894–1989) and in consultation with Willy Ley (1906–1969), an early public supporter of spaceflight research and, along with Oberth, an early member of the Verein für Raumschiffahrt (VfR).[250] *Frau im Mond*, as Alexander Geppert has argued, established an "imagery of outer space" through the productive relationship between Lang's filmic vision and Oberth and Ley's scientific modeling. Neufeld has attributed this cultural interest in space and spaceflight to a potent combination of rising nationalist sentiment, which celebrated advances in rocket technology by Oberth and others as "the latest accomplishments of German technology"; a "widespread faith in technological progress" in the period of stabilization after around 1923; and a modern consumer culture which encouraged "an appetite for spectaculars."[251] These three factors developed and sustained an excitement around spaceflight in this period.

Curiously, however, the planetarium does not appear to have participated in this nascent space enthusiasm movement. No extant records show any visits from the VfR or any of the other rocket enthusiast groups to the Berlin planetarium, though Berlin regularly sent reports of special interest group visits back to Carl Zeiss in Jena. There is no extant documentation of any correspondence between the rocket enthusiasts and the planetarium. The premier of *Frau im Mond*, in October 1929, was held at the Ufa-Palast, directly around

[250] Michael J. Neufeld, "Weimar Culture and Futuristic Technology. The Rocketry and Spaceflight Fad in Germany, 1923–1933," *Technology and Culture* 31 (1990), 727.
[251] Ibid., 749.

the corner from the planetarium, and featured an enormous redressing of the theater's façade in honor of the film. Graphic designer Rudi Feld's façade featured a "sculpted rocket being launched from a three-dimensional skyscraper city that jutted out from the wall of the theater in the lower right side and traveling diagonally up to the moon on the upper left and back down to the city again."[252] The dark blue backdrop to the display was studded with a thousand small electric stars. And yet despite the close geographical and thematic proximity of the film to the planetarium, no mention is made of the film, or of any attempt to capitalize on the space enthusiasm it brought to the area, in any of the extant planetarium documents.

What are we to make of this absence? It would be ill-advised to conclude that participants in this space enthusiast moment were unaware of or uninterested in the planetarium. What we can conclude, however, is that, based on the limited source material available, the planetarium did not seek out these other actors, or actively engage in this enthusiastic moment. In part, this might be due to the type of experience it offered. *Frau im Mond*, the *Verein für Raumschiffahrt*'s journal *Die Rakete*, or Ley and Oberth constructed an "imagery of outer space," in which outer space emerged as a place to which someone might travel, or which technology might conquer. By contrast, the. planetarium's vision of outer space was secondary to its demonstration of its machine, and a desire to amaze its audience. What the Berlin planetarium offered, rather than an escape into outer space, was a return to a home obscured by modernity.

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[252] Janet Ward, *Weimar Surfaces. Urban Visual Culture in 1920s Germany*, (Berkeley: University of California Press, 2001), 169.

The Berlin projector was a distinctly different machine than the original "Wonder of Jena" that Bauersfeld designed for the Deutsches Museum. The Mark I was a limited machine for several reasons. First, the projectors mounted on the surface of the globe were able to reproduce the magnitudes and relative sizes of the stars but lacked the precision necessary to differentiate their colors, and were also unable to reproduce the proper motions of the stars. Some of the larger stars grew blurry at the edges if the lamp was turned on too brightly. In order to fill the entire hemispherical dome of the planetarium with the full star mosaic, the projector had to be mounted almost three meters above the floor, which gave the impression to the spectators that they were seated below ground level. There was very little range of motion in the latitudinal direction; the projector was thus essentially able only to reproduce the sky above Munich.

The second generation of projectors, which every planetarium after Munich purchased, had been completely redesigned. In 1924, after a successful trial run of the Mark I projector in Jena, Walter Villiger (1872–1938), the scientific manager for the Zeiss company's optical instrument department, suggested the addition of a second hemisphere of stars. The Mark II that Villiger designed with Bauersfeld was shaped like a massive dumbbell, divided in the middle. One half of the dumbbell projected objects in the northern hemisphere, and the other reproduced the southern hemisphere. Including the large metal frame, which anchored the projector at its center and acted as a fulcrum around which the machine would rotate, the whole apparatus reached nearly five meters and it weighed a total of 2500 kilograms. It was, wrote one visitor to the Berlin planetarium, "so unlike anything with which even engineers are familiar that it might be taken for the fantastic

creation of some Martian inventor. […] This cylinder with its two knobs is the brain, heart, soul, and *deus ex machina* of the planetarium."[253] [*Figure 4.9*]

This new projection apparatus also solved the first model's problems with apparent magnitudes, colors, and proper motions, and its planet projectors were more fine-tuned and adjustable. Although this new model was significantly larger than the original, the fulcrum of the dumbbell was lower to the ground, which removed the peculiar underground sensation the original model's height had produced. The overall effect was far more natural, as the same visitor remarked:

> In [the planetarium], the 'firmament of the heavens' is being reconstructed with a perfect illusion of reality. The sun, the moon, the planets and all the stars that one can see blaze up suddenly out of the darkness with an eerie but awe-inspiring naturalness. The walls seem to have been removed by magic hands and the starry, deep-blue canopy of the heavens is apparently stretched out in infinite space above us.[254]

As the lights dimmed and the dome was plunged into darkness, "you lose," he continues, "all sense of confinement":

> In some incomprehensible optical way you have been transported out into the open on a marvelously pellucid night … A miracle happens. A switch has been thrown, and that cerulean vault suddenly becomes a firmament of twinkling stars. Even trained astronomers who know exactly what to expect cannot suppress a long-drawn "ah-h-h!" of astonishment and pleasure when they behold this dramatically presented counterfeit of the heavens for the first time.[255]

[253] Waldemar Kaempffert, "Now America Will Have a Planetarium," *New York Times* (24 June 1928), 5.
[254] Ibid.
[255] Ibid.

Another writes: "So true to life is the image of this artificial starry heaven, that man has the unshakeable impression of being truly out underneath the star-studded sky itself."[256] The editor of *Scientific American*, after a survey of German planetaria, reported that when the projection apparatus was switched on, "the confining dome retreats to infinity. [How] perfect is the verisimilitude. The dome seems to vanish by magic."[257]

The shows played in Berlin were a mixture of hour-long scripts that were circulated among planetarium directors across Germany, and original "special programs" written specifically for Berlin. Unfortunately, the transcripts of these special programs were mostly kept in the Berlin planetarium itself and were lost along with many of the administrative records during the 1943 bombing that destroyed the planetarium and much of the Zoo. Nonetheless, from the surviving correspondence between Berlin and Jena preserved by the Zeiss company, and from the transcripts of the shared scripts, we can begin to assemble a more precise impression of what visitors saw when they entered what one reviewer called "really, a moving picture of the sky."[258]

One popular show in 1927, "The Year in a Matter of Minutes," promised a dizzying display of mechanical dexterity that would nonetheless ultimately be educational. "We would like," explained the introductory script, "in these artificial heavens, to let time advance wildly, so that we can better study the movements of our neighboring stars."[259] With this promise, the room was plunged into darkness, and the performance began. First,

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[256] G.M. Morison, "Die Geheimnisse der Sterne," *Westermanns Monatshefte* (February 1925), 580.
[257] Jordan D. Marché, *Theaters of Time and Space: American Planetaria, 1930–1970* (New Brunswick, NJ: Rutgers University Press, 2005), 17.
[258] Otto D. Tolischus, "Seeing Stars," *The World's Work* 55 (1927) 96.
[259] "Das Jahr in wenigen Minuten," 1927, Carl Zeiss Archive, ASTRO 0422, 1.

the lecturer presented a series of photographs, showing the planets of the solar system, while explaining the history of the astronomical study of orbits. As the historical lesson drew to a close, the photographs were removed, the planetarium projector itself slowly came to life, and the main act of the show began.

The projector began lazily rotating, the stars, planets, and a disk representing the sun slowly moving across the dome. In four minutes, the projector had completed one full rotation, a single day. As the lecturer began to point out recognizable constellations and demonstrates the difference in apparent motion between distant stars and neighboring planets as they track across the sky, the projector started moving slightly more quickly. Just as the speed became noticeably more rapid, the projector stopped abruptly. "We are making," announced the lecturer, "an intervention into the natural order! Here we are stopping the rotation of the Earth, for just a moment." The outlines of constellations suddenly appeared over the stars, and the lecturer pointed out Taurus, the bull, and Castor and Pollux, the twins, visible clearly over the meridian. Just as quickly, the constellation overlay disappeared, and the projector began to spin, far more quickly than before. Planets and stars whirled by, and in seven minutes, an entire year had passed. The lecturer sped up the motor even more, and this time, accomplished the feat in four minutes. The motor turned more quickly, and a year's worth of rotations took a mere minute and a half. At this point, the noise from the projector's motor, while not deafening, would echo loudly in the otherwise silent dome, offering a mechanical accompaniment to the dizzying display above. Then the projector was abruptly flipped, and visitors were suddenly presented with the sky of the southern hemisphere, rotating just as quickly. "A trip around the world!" explained the lecturer. At last, the motor began to slow, and the lecturer announced a

"return to reality," as the projector came to a stop, and the house lights slowly came back on.[260]

The disorientation of this performance was enhanced by the inclusion of a disk representing the sun moving along the equator; that is, the sky projected on the dome's surface was not only the sky you might see at night, if all the electric lights were turned off, but also the stellar array you would be able to see during the day, if the sun were extinguished. The experience offered in this show is close to something familiar, but the unbelievable acceleration of time, combined with the revelation of the sky normally obscured by the sun, produced something decidedly unfamiliar.

The dynamism of "The Year in a Matter of Minutes" was balanced by the more sedate but also more popular "The Skies of Home," ("Der Himmel der Heimat") which ran on and off alongside it from 1927 into the early 1940s. Whereas "The Year in a Matter of Minutes" used the power of the projector to produce a dizzying spectacle of rotation, "The Skies of Home" was a slower journey through the local night sky. As the projector spins slowly, according to the lecture script, the audience hears about the various planets that might be visible that time of year, the constellations that are closest to the zenith, and the variations in the paths of the sun and moon across the sky. The lecturer gives a brief lesson in apparent motions and retrograde orbits, using an arrow-shaped flashlight beam to illustrate his examples. This show in particular made use of an extra design feature of the planetarium; all along the horizon of the dome was a small silhouette of the Berlin skyline. A similar feature existed in the original planetarium in Munich, though few other planetaria

[260] Ibid, p. 2.

permanently adopted it. In Berlin, however, it stayed. The original goal of the silhouette was to provide a schema of orientation for the audience, so that the startling clarity of the projected sky could be mapped onto familiar landmarks. Visitor numbers of specific shows no longer survive, but from reports the Berlin office sent back to the Carl Zeiss headquarters, "The Year in a Matter of Minutes" appears to have been the second most popular show, running on and off for nearly a decade. The "Skies of Home" ran more often, and for longer stretches than any other show performed in Berlin.[261]

Taken together, these two shows represented the scope of the spectrum that the planetarium experience offered. On one end, as one visitor remarked, "we are bound to neither time nor space. […] It looks," he continued, "as if in a jazz age even the heavens were moving in jazz time."[262] On the other, the planetarium serves as a grounding force, orienting the audience in a disorienting world. "Often," read the lecturer at the beginning of "The Skies of Home", "have we all of an evening or night turned our gaze briefly skyward, to catch a glimpse of the unreachably distant glitter of the celestial dome. But only very rarely have any of us been permitted to see the sky as it really appears, without any of the sight-obstructing influences around us."[263] The fact that this show was by far the most popular suggests that visitors, as much as they enjoyed the disorienting "jazz age" effects, consistently preferred the grounding effect of seeing their own sky.[264]

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[261] This information was collected from several decades' worth of bi-monthly reports on the various Zeiss planetaria, compiled from each city's own reports sent back to Jena; see Carl Zeiss Archive, BACZ 3075.
[262] Tolischus, "Seeing Stars," 98.
[263] "Der Himmel der Heimat," 1927, Carl Zeiss Archive, ASTRO 0422, 1.
[264] One cannot take this kind of speculation too far, of course; the lack of documentation and reports from viewers themselves prevents me from saying decisively why they preferred this performance, or why the planetarium put the performance on as much as it did. However, as I hope to show in the following section, the "Skies of Home" spoke to the planetarium's ability to give viewers a respite from urban life by constructing a fantasy space of calm rural openness.

The planetarium might be thought of as a kind of heterotopia, to borrow from Michel Foucault. In his essay "Of Other Spaces" he defines the term as "capable of juxtaposing in a single real place several spaces, several sites that are in themselves incompatible."[265] Foucault cites as examples a theater, a cinema, and an ornamental garden, all of which are built specifically to contain multiple spaces at once – the physical space of the stage, for example, overlaid by the more imaginary space created by the theatrical set pieces. The zoo and the planetarium fit into this constellation of examples. The framework of the heterotopia is particularly fruitful when we consider one of the defining traits of the heterotopia, according to Foucault: that it has "a function in relation to all the space that remains."[266] On one hand, the heterotopia can create a space of illusion "that exposes every real space […] as still more illusory," and on the other hand it can create a space of compensation, "as perfect, as meticulous, as well arranged as ours is messy, ill constructed, and jumbled."[267] In both cases the space produced in the heterotopia reveals a truth about the space outside that otherwise might be obscured. In the case of the planetarium, with its shows that whet its audience's appetite for spectacle and promoted an orientation around the *Heimat*, its technological illusions exposed the illusory qualities of the city outside, and offered viewers a calm, well-ordered cosmos away from the disorienting landscape that awaited them outside its doors.

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[265] Michel Foucault, "Of Other Spaces," *Diacritics* 16 (1986,), 22–7.
[266] Ibid, 27
[267] Ibid.

In 1844, when the Zoo first opened, the area in which it stood was a relatively sedate corner of the western part of Berlin. By 1926, it stood in an entirely different-looking city. Beginning in the 1910s, the area along Tauentzienstraße and Kurfürstendamm developed into a vibrant, dazzling commercial center of flashy electric advertisements, variety shows, hotels, and cinemas.[268] In the midst of this spectacular environment, the Zoo train station opened onto a small constellation of landmarks of entertainment. To the south stood the Ufa Palast, which by 1925 was the largest cinema in Germany. Further down, near the Kaiser Wilhelm Memorial Church, stood the Capitol, the Marmorhaus, the Tauentzienpalast, and the Gloria-Palast. Sabine Hake has observed that the Kurfürstendamm area in this period "functioned as a showcase not only for a dazzling array of consumer goods and popular diversions but also for the most advanced architectural styles and designs."[269] Those who celebrated it called it the "Broadway of Europe"; its detractors hated the sheer scale of its speed, light, and noise.[270] It was aggressively new, relentlessly modern in its renovations and rebuildings which erased the older structures and replaced them with what Peter Fritzsche has termed a "fugitive city," or what Siegfried Kracauer called a "street without memory."[271]

The Kurfürstendamm was even more dazzling at night, when the electric lights were turned on, and the street was bathed in a bright neon glow. Increased regulations on the brightness of electric advertisements in the 1920s drove the development of more

[268] Hake, *Topographies of Class*, 138.
[269] Ibid., p. 137.
[270] Ward, *Weimar Surfaces*, 181.
[271] Fritzsche, 189. Siegfried Kracauer, *Straßen in Berlin und anderswo* (Frankfurt a.M.: Suhrkamp Verlag, 1964), 23.

sophisticated neon displays that were flashy but clear rather than simply blinding.[272] Far more than in other major European cities, Berlin experimented with the integration of these more flexible neon displays into the architecture of the buildings themselves, creating what Janet Ward called an "architecture of light."[273] [*Figure 4.10*] This was especially on display during the 1928 festival *Berlin im Licht*, in which the city was completely illuminated; all of the monuments, the major streets, and the large commercial buildings were bathed in electric lights, and on top of the Siegessäule, the Osram electric company mounted a neon sign which read "Light is life."[274] The illumination of the streets at night created a palimpsestic second city, an electric facade on top of the one that existed during the day. This new neon night sky – completely artificial, and completely modern – stands in stark contrast to the electric sky produced by the planetarium, which was a sky that could only have been seen if all the lights were turned off. [*Figure 4.11*]

The *Berlin im Licht* festival was only a particularly all-encompassing articulation of the more general integration of technology into the fabric of the city. For Kracauer and many of his contemporaries, this was profoundly disorienting; it required a constant reorientation on the part of those walking through those streets. The city itself became a spectacle in which, as Peter Fritzsche has put it, "the rapid alteration of images reduced dazzled spectators to the level of appearances and to the immediacy of *Erlebnis*."[275] This feeling could be liberating and titillating - one feuilleton writer wrote that this fast-paced

[272] Frances Guerin, *A Culture of Light. Cinema and Technology in 1920s Germany* (Minneapolis: University of Minnesota Press, 2005), 5.
[273] Ward, *Weimar Surfaces,* 110.
[274] Ibid., 107. Ward also notes that the number of lights on the Leipziger Straße inspired people to begin calling it the "Milky Way."
[275] Fritzsche, *Reading Berlin*, 131.

spectacle confounded "tourists seeking pleasure" but rewarded those with a taste for adventure and exploration, willing to tour the depths of Berlin, "a metropolis of pleasure, equally dazzling whether by light or dark."[276] Another wrote that "in the night air, which makes even the spires of the Gedächtniskirche flicker with excitement, there is a throbbing sense of expectancy. Everyone knows that every night Berlin wakes to a new adventure."[277]

At the same time, however, a distrust of this technological adventure was articulated as a desire to get out of town and return to the countryside. Ludwig Finckh, fervid conservationist and, later, an equally enthusiastic member of the National Socialists, wrote in 1919, as this cultural landscape was establishing itself, that Berlin, "once a symbol of power and splendor," is now "one of decay. Everything is topsy-turvy there; guns go off on their own, wolves have been turned into deer."[278] "To the spirit of Berlin," he concluded, "another must be opposed: *the spirit of Germany*!"[279] Finckh's conservationism was informed and supported by his fascist distrust of the liberal wasteland of Berlin and his subsequent reverence for the provincial countryside.[280]

In her definitive 1992 account of the concept of *Heimat* in the Weimar Republic, Celia Applegate argued that "the language of *Heimat* helped people to 'remember' the lost Eden of their prewar lives" because *Heimat* "suggested stability, changelessness, harmony and purpose."[281] The romanticism inherent in this attitude is clearly visible in something

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[276] Curt Moreck, "Wir zeigen Ihnen Berlin," *Ein Führer durch das "lasterhafte" Berlin: Das deutsche Babylon* (Leipzig 1931), 6.
[277] Harold Nicolson, "The Charm of Berlin," *Der Querschnitt* 9 (1932), 346.
[278] Ludwig Finckh, "Der Geist von Berlin," *Schwäbischer Merkur* 14 (10 January 1919); reprinted in Anton Kaes et al. (ed.), *The Weimar Republic Sourcebook*, (Berkeley: University of California Press, 1994), 414.
[279] Ibid, p. 415.
[280] Frank Uekötter, *The Green and the Brown. A History of Conservation in Nazi Germany*, (Cambridge: Cambridge University Press, 2006), 10.
[281] Applegate, Question of *Heimat*, p. 68.

like Martin Heidegger's 1933 radio broadcast "Schöpferische Landschaft: Warum bleiben wir in der Provinz?"("Creative Landscape: Why Do We Stay in the Provinces?") in which he paints a lush picture of his "authentic" life among peasants in the country, where "the gravity of the mountains and the hardness of their primeval rock, the slow and deliberate growth of the fir tree, the brilliant, simple splendor of the meadows in bloom […] moves and flows through and penetrates daily existence."[282] At the end of the piece he recalls being offered a position at the University of Berlin, but declining after he consults his mute octogenarian farmer friend in the Black Forest.

Heimat in this period is often explicitly positioned against urban life – the spirit of Germany against the spirit of Berlin, or the spirit of communal life in the country against the atomization of the city.[283] There was a pervasive sense that city life necessitated a loss of some kind – a loss of heritage, of community, of togetherness – that a return to the Heimat could salvage.[284] There is a distinct echo of this sentiment in the planetarium literature of this period – by this I mean both the extant lecture notes, as well as the propaganda material and feuilleton articles about the planetarium. Specifically, much of the contemporary praise for the planetarium is about its ability to respond to the atomization of modern man. There is a sense of urgency in this literature, a belief that the planetarium offers something that is not only enjoyable, but crucial, that it fills a dangerous hole created by a modern distancing of man from nature, and men from one another. As

[282] Martin Heidegger, "Schöpferische Landschaft. Warum bleiben wir in der Provinz?" *Der Alemanne* 1 (7 March 1934), 4. In *Weimar Republic Sourcebook*, 426.
[283] See Lekan, *Imagining the Nation in Nature*, 99–152.
[284] For a thorough overview of this sentiment, see Walter Lacqueur, *Young Germany: A History of the German youth movement* (New York: Basic Books, 1962).

one visitor to Berlin wrote, "Among the many drawbacks from which the modern city man suffers unbeknown to himself is his gradual loss of understanding and appreciation of the grandeur and fascination of nature, of which the most common and yet the most beautiful and overpowering spectacle is the starry sky above us."[285] In the opening of the Berlin planetarium propaganda pamphlet, the authors write that "Many men live in large cities right on top of one another; their lifestyles make it so that they see very little of the sky at night as it truly is."[286] A New York visitor touring all the German planetaria wrote that "the crowding of hundreds of thousands into large industrial centers is chiefly responsible for the decline of popular interest in the noblest of sciences."[287] Overcrowding – men right on top of each other, underfoot, everywhere – is, in these formulations, directly responsible for the loss of a healthy appreciation for nature. The planetarium, by logical extension, is the place to reclaim it. [*Figure 4.12*]

We find an ironic reworking of this sentiment in Walter Benjamin's fragmentary impressions of Berlin, published in 1928 as *Einbahnstrasse*. In the final section, titled "Zum Planetarium," he writes that:

> Nothing so distinguishes ancient from modern man as the former's submission to a cosmic experience of which the latter is scarcely aware. […] Classical dealings with the cosmos took a different form: intoxication [*Rausch*]. […] Communicating ecstatically with the cosmos is something man can only do communally. Modern man is in danger of mistakenly dismissing such an experience as trivial, dispensable, and leaving it to the individual – a rush of enthusiasm on fine starry nights.[288]

[285] Otto D. Tolischus, "Seeing Stars" *The World's Work* 55 (1927) 96–7.
[286] *Das Planetarium der Stadt Berlin*, p. 13.
[287]Walter Kaempffert, "Now America Will Have a Planetarium," *New York Times*, 24 June 1928.
[288] Walter Benjamin, *Einbahnstraße*, trans. J.A. Underwood (New York: Penguin Books, 2009), 113.

In Benjamin's formulation, the planetarium's artificial, technological cosmos might allow for a communal intoxication under the manufactured heavens.[289] The desire for a reintoxication of man's relationship to the cosmos is addressed explicitly in the Berlin planetarium's promotional material:

> The view of the starry heavens offers because of its beauty an intense pleasure, and the philosopher Kant himself once said that his observation of the heavens filled his soul with an ever new and increasing admiration (*Bewunderung*) and reverence (*Ehrfurcht*). Doesn't the night sky, with its thousands of brilliant stars and the twinkling Milky Way, make a gorgeous picture? No beginning, no end in sight, everything in glorious disarray…[290]

This paragraph is directly referencing Kant's *Critique of Practical Reason*, in which he wrote that what fills him again and again with this *Bewunderung und Erfurcht* is "the starry heavens above me, and the moral law within me."[291] In referencing the sublime heavens of Kant, the brochure offered the same experience of *Bewunderung und Ehrfurcht* to the visitors of the planetarium. The Berlin planetarium, we are meant to assume, was capable of these feats of enchantment, could produce the feeling of sublime, infinite nature that has somehow been lost in the bewildering overstimulation of the city.

When the planetarium lecturer speaks to the crowd, during "Der Himmel der Heimat," he tells them that "only very rarely have any of us been permitted to see the sky as it really appears," the implication is that the planetarium can offer that to its attendees –

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[289] For a more in-depth analysis of this text in the context of Benjamin's oeuvre, as well as contemporary conservative thought that Benjamin was ironically reworking, see von Hermann, "Die bestirnte Himmel über mir…"

[290] *Das Planetarium der Stadt Berlin*, 11.

[291] The former, he continues, begins from outside himself and enlarges "my connection to an unbounded extent with worlds upon worlds, and systems upon systems," whereas the latter "begins from my invisible self, my personality, and exhibits in me a world which has true infinity." Immanuel Kant, *Kritik der praktischen Vernunft,* in *Werkausgabe*, Bd. VII, (Frankfurt a.M.: Suhrkamp Verlag, 1974), 300 (Absatz 289).

not a simulacrum, but the sky "as it really appears." The starry firmament that the planetarium's projection technology produces, of course, one that could never exist in the modern city. The stars are too clear, too numerous; the closest natural approximation to the planetarium sky would be, perhaps, an isolated mountaintop. A sky as clear as that produced by the Zeiss machine could never exist in a city polluted by light and smoke. Nonetheless, as has been shown here, visitors routinely praised the planetarium's sky for its verisimilitude, its ability to recreate the real starry sky "as if by magic."

This sky, the sky of the *Heimat*, is one unimpeded by the distractions of modern urban life; it is a sky "of the ancients," as one visitor phrased it. The stars were "the world's first motion picture theater... [the ancients] had no broad, smooth highways upon which to speed in automobiles. They had no cinema. They had no brightly lighted concert halls. The heavens at night were their theater."[292] Thus the planetarium is celebrated for its ability to bring that ancient sky to modern city inhabitants, to give them the same intoxication that ancients would have felt. The planetarium is a space for people to come and, even for a brief moment, get out of town and immerse themselves in a darker, clearer, older sky.

Jeffrey Herf's formulation of reactionary modernism is useful here for understanding the peculiar balance in the planetarium of both being a "jazz age" technology, able to spin and twirl and dance in jazz time, and fulfilling a desire to feel very far away from the overstimulation of the city. The reactionary desire to escape coexists in the planetarium with the thrill of technological prowess. One of the central tenets of the reactionary modernism of the Weimar period, according to Herf, was belief in the strength

[292] Quoted in Griffiths, *Shivers Down Your Spine*, 137.

of *Gemeinschaft* (community), over the fragmentary *Gesellschaft* (society) that modernity had wrought.[293] *Gemeinschaft* offered strength in unity, a genuine sense of community, in place of the *Gesellschaft*, whose divided and diverse nature was alarming and unnerving. Community, in this system, became romantic and unifying, even totalizing.

This rhetoric appears in a number of reactionary texts from this period (Oswald Spengler's *Preussentum und Socialismus*, for example), but we find an echo of it in this planetarium literature as well. The Berlin planetarium suggests that many men live "right on top of one another," but in spite of this overcrowding, are still isolated from each other and from the natural world around them. The planetarium then offers not just an escape from the overwhelming stimulation of the city but a space for a new kind of community formation. Benjamin ironically evokes this when he argues that "communicating ecstatically with the cosmos is something man can only do communally," but this feeling is echoed genuinely in literature that praises planetaria for the communal experience they offer. This is not to suggest that the planetarium literature of this period is deliberately engaging with the language of the reactionary conservatives, but to suggest that the planetarium engaged with the same kind of anxieties that the reactionary conservatives experienced. In the following chapter, I will explore how these conservative undercurrents evolved in the planetarium after 1933, when the proto-fascism of the reactionary Weimar conservatives evolved into the full fascism of the Nazi period.

[293] Herf, 36.

Chapter IV: Under Germanic Skies
Planetaria in the Third Reich

On the 12 October, 1935, three hundred men in uniform assembled outside of the Jena planetarium. The columns of the veranda were festooned in garlands, and a brass band serenaded the crowd.[294] [*Figure 5.1*] Between the columns more than a dozen party flags fluttered in the mild breeze. Inside the dome, the planetarium projector was similarly outfitted, with the protective railing around it draped in red and white bunting, the swastika prominent in the center of the swag. The congregation at the planetarium was the culmination of a four-day long tour of the Thuringian countryside for "300 of the longest serving political leaders of the NSDAP," a tour which, according to the promotional account of the trip, "has proven that national socialism in Thuringia has won the hearts of all our fellow Germans [*Volksgenossen*]."[295] Among the crowd were some of the highest-ranking Nazi party members in the country, including Reichsleiters Robert Ley and Philipp Bouhler, along with many regional party officials and members of the Nazi press.[296] [*Figures 5.2 and 5.3*]

They had assembled for a exhibition of the planetarium by Walter Bauersfeld, chief engineer of the planetarium project. Bauersfeld performed a short routine with the apparatus, showing the stars above Jena and accelerating through several years of rotations. After the demonstration, Bauersfeld turned to Ley and gave a short speech of thanks:

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[294] "Besuch des Planetariums Jena durch die 300 dienstältesten politischen Leiter der NSDAP," 29 October 1935, ARCHIV 01346, Carl Zeiss Archive.

[295] Ibid. The pamphlet explains the reason for its existence: "[The tour] was so glorious [*herrlich*] and dazzling [*überwältigend*], that we felt it necessary to commit this marvelous experience to words and pictures vividly for posterity." The pamphlet was addressed to "our dearest fellow party members" and was available for a very reasonable price.

[296] Ibid. Robert Ley was head of the Deutsche Arbeitsfront and Gauleiter of the southern Rhein region, and Phillip Bouhler was later the chief of the Aktion T4 mass euthanasia program.

> We want to be proud of the great accomplishments of the creative [*schöpferischen*], brooding [*grüberlischen*], Faustian [*faustischen*] German humanity. But for so long, [this German humanity] had not yet realized that in all the world, in space [*im All*], on the earth, from within as well as without [*sowohl im Innern vie im Außern*], it was not chance, but rather, because everything proceeds according to eternal, prescribed, and unchanging laws, that it has become what it has in this hour! And this insight is what the Führer has understood so deeply and thoroughly, which is why he did not rest until he had fought for a life for his people that suited their species and their blood![297]

"It was clear," reported one of the attendees, "through the increasingly rapturous applause how much the magnificent German ingenuity and audacity on display touched the hearts of the listeners."[298] Bauersfeld's demonstration fulfilled a two-fold purpose: first, to show off this "unparalleled starry wonder" as a marvel of German ingenuity, and second, to imply that Germany's fate was written in the stars, predetermined by the immutable laws of the universe, as prescribed and eternal as the motions of the planets.

Most historical accounts of the early years of the planetarium stop short of 1933 and the rise of the Nazi party, or they skip over the period from 1933 to 1945 entirely, and resume in the early years of the Cold War conflict. Since most histories of the planetarium are concerned with the technological history of planetarium development, and since no advances in planetarium design were made during the Third Reich, this omission is hardly surprising.

One account that does engage the question of planetaria during the Third Reich is architect William Firebrace's amateur history of the planetarium, *Star Theater: the Story*

[297] Ibid
[298] Ibid., 27.

of the Planetarium.[299] Firebrace claims that no new planetaria were built after Hitler came to power, as the Nazis "[regarded] the whole planetarium venture with distrust, since planetariums supposedly resembled synagogues and were therefore considered part of a Jewish conspiracy."[300] Firebrace is mistaken on a number of accounts here, but his interpretation is indicative of a paucity of scholarship on the subject. To begin with, though Zeiss did not install any new full-scale planetaria within Germany after 1930, this is largely because most major German cities already had one. Zeiss was still selling planetaria abroad until about 1937; Philadelphia's Franklin Institute purchased a Mark II in 1933, as did the city of Den Haag, while New York's Hayden Planetarium opened in 1935, as did Los Angeles's Griffith Planetarium and a planetarium purchased by the city of Brussels. Three new planetaria in Osaka, Tokyo, and Paris opened during the summer months of 1937.[301] Besides the international installations, Zeiss also sold at least two "Kleinplanetarien."

Firebrace's note about the distasteful resemblance to synagogues comes from the case of the Nuremberg planetarium, which opened in 1927. It was architecturally unusual, even among the diversity of planetaria designs of the period. A tall cylindrical building with a decorative doorway that went all the way up to the roof [*Figure 5.4*], the Nuremberg planetarium was a dramatic addition to the Stadtpark in which it stood. In July 1926, *Der Stürmer*, the virulently anti-semitic tabloid run by Julius Streicher (later, the Gauleiter of Nuremberg) published a short editorial (mostly likely written by Streicher himself) on the

[299] William Firebrace, *Star Theater: the Story of the Planetarium* (Chicago: Reaktion Books, 2017). Firebrace, an architect, has also discussed the planetarium in a long article. See Firebrace, "The Missing Planet," *AA Files* 66 (2013), 126-44.
[300] Firebrace, *Star Theater*, 74.
[301] "Zeiss-Planetarien in aller Welt," *Zeiss Werkzeitung* 9 (no. 6, December 1936), 114-115.

planetarium, which was still under construction. Speaking of the site, Streicher writes that "You might think it is a new synagogue, or even a mosque […] How far from the truth! What is under construction and what requires such a large dome is neither synagogue or mosque, but planetarium."[302] The rest of the short editorial argues that there is no need for such a wasteful building, as the stars above, which have served the ancestors well, would do just fine for the citizens of Nuremberg now.

During his trial for crimes against humanity after the war, Streicher recalled that after the Nazi seizure of power in 1933, he told the mayor of Nuremberg to tear down both the old synagogue and the planetarium, both of which he found offensively Jewish-looking.[303] The planetarium was indeed torn down in early 1934, though a Zeiss report on German planetaria from 1936 claims that "the Zeiss-Planetarium of Nuremberg has been dismantled due to urban planning considerations. It will soon be rebuilt next to the city of Nuremberg's observatory."[304] It was not rebuilt until 1961. The story of the destruction of the Nuremberg and Streicher's involvement has been documented in several English-language histories of Nuremberg and Streicher, and Firebrace appears to have taken the Nuremberg case as indicative of a larger trend.

However, the destruction of the Nuremberg planetarium appears to be an outlier in the history of planetaria in the Third Reich rather than the norm.[305] My research has shown

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[302] "Planetarium," *Der Stürmer* 37 (July 1926).
[303] Nuremburg Trial Proceedings, 29 April 1946, morning session.
[304] "Zeiss-Planetarien in aller Welt" (see footnote 8).
[305] The Nuremberg planetarium is the only planetarium to be fully demolished in this period. The Dresden planetarium was also converted to a cinema in 1933, though no documentation survives accounting for thr shift. It also bears noting that Julius Streicher, who was responsible for the destruction of the Nuremberg building, was himself an outlier in the Nazi Party, and was declared "unfit for leadership" after a feud with Hermann Göring in 1939.

that rather than cultivating an aversion to planetaria on the basis of their "synagogisch" architecture, Nazi party officials frequented them throughout the Third Reich, attending lectures and performances, using the buildings as event spaces, and bringing members of the military in to learn the art of stellar navigation. In fact, as Bauersfeld's speech to the NSDAP members demonstrates, the planetarium was often held up as a triumph of German technological brilliance and celebrated as an extraordinary German achievement. This embrace is a logical successor to von Miller's original dream of a pan-Germanic technological nationalism.

Rather than focusing on a particular planetarium, this chapter examines a cross-section of planetaria in operation from 1933 to the early 1940s and argues that planetaria in this period operated as places in which Nazi ideas of German identity and the physical occupation of space were negotiated and articulated. The planetarium became a site to explore both imperial fantasies of conquest as well as the notion of a German identity rooted in German land, watched over by a German sky.

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After the Nazi seizure of power following the March 1933 national elections, the newly-convened Reichstag, now communist-free and meeting for the first time since the Reichstag fire of 27 February, passed the Enabling Act, which allowed Hitler as Chancellor to pass laws without the approval of the Reichstag. Soon after, the first of several laws was enacted to begin the process of *Gleichschaltung*, or coordination, during which the Nazi government consolidated control over German social structures, including industry, civil service, and the realm of cultural production.

During the *Gleichschaltung* process, the Carl Zeiss Company found itself in a peculiar position. Thuringia as a whole had voted in favor of the Nazi party – as we saw in the second chapter, Thuringia had been an early adopter of the Nazi party in the 1930 regional election.[306] In Jena, however, the members of the party tended to belong to the more moderate camp.[307] Nonetheless, as part of the first wave of *Gleichschaltung*, key members of the local government were ousted and replaced by loyal party officials. The Foundation Commissioner position of the Ernst Abbe Stiftung of the Zeiss company (which readers will recall from Chapter 2 was the progressive public outreach wing of the company that governed rules and benefits of employment, as well as community service) was particularly targeted at this moment, because while the position had no official government role, it did oversee the vast majority of the Company's public operations. The Commissioner, a Dr. Ebsen, was ousted by the Thuringian interior minister and replaced with a staunchly loyal party member named Julius Dietz. Dietz, supported by the Gauleiter of Thuringia, immediately attempted to dismantled one of the central tenets of the Stiftung's rules – namely, that no employee could be dismissed on the basis of religious affiliation.[308]

However, Dietz encountered a surprising amount of resistance from other officials in the Stiftung. The resistance was led by Grete Unrein, the last surviving daughter of Ernst Abbe, and a committed member of the liberal Deutsche Demokratische Partei. Unrein

[306] Donald R. Tracey, "The Development of the National Socialist Party in Thuringia, 1924-1930," *Central European History* 8 (1 March 1975), 23-50.
[307] Rolf Walter, *Zeiss: 1905-1945*. Carl Zeiss: Die Geschichte eines Unternehmens, ed. Wolfgang Mühlfriedel and Rolf Walter, vol. 2 (Weimar: Böhlau Verlag, 2000), 165.
[308] Ibid, 165-167.

successfully filed a lawsuit against the Thuringian government for forcing changes to the Stiftung's laws that it was not legally allowed to make, and the conflict grew so acrimonious and troublesome that recently-appointed Reichsleiter Robert Ley had to intervene. Although Ley ensured the abolishment of the rule, he allowed Dietz to be unceremoniously ousted in early 1934 and replaced with a longtime Stiftung member, Professor Abraham Esau from the university in Jena.[309] Ley also authorized the reorganization of the Stiftung's youth group, the Ernst Abbe Jugend, into the larger body of the Hitler Youth, which prompted criticism but no outright protest.[310]

During this period of intense acrimony, Walter Bauersfeld (chief engineer of the planetarium project in 1923, and a decade later, one of the highest-ranking directors in the company) attempted to strike a middle ground between Dietz and the furious members of the Stiftung led by Unrein. He reflected on his position after the war:

> I felt we would be able to ward off attacks more easily, if we pledged ourselves to the Party. It was urgently hoped-for that more decent and well-educated people would start to take part in party life. For this reason I myself decided to become a contributing member of the SS, with a modest monthly contribution of 4 to 6 RM. At the time [the SS] was not in any way as disreputable [*anrüchig*] as it later became.[311]

Bauersfeld's postwar account, of course, should be read with a healthy dose of skepticism; many postwar accounts cast their writers as nervous, reluctant adopters, when in reality they were at the time quite enthusiastic, and the surviving record of Bauersfeld's speech to assembled party officials suggests that he was comfortable in his party role. But

[309] Ibid, 169.
[310] Untitled news bulletein, *Zeiss-Werkzeitung* 1(6) (January 1934), 19.
[311] Quoted in Walter, 168. Also available in BACZ 13671, Carl Zeiss Archives.

it is telling that Bauersfeld framed his involvement as part of a larger company-wide policy, especially after Ley's intervention and the failure of Unrein's lawsuit. Many of the upper-level directors and managers attempted to negotiate an interstitial space between an enthusiastic embrace and outright resistance, which would have, they feared, resulted in a full demolition of the company.

Thus by 1935, Zeiss management maintained a cordial relationship with the local NSDAP officials, while still managing a degree of independence.[312] They continued to do business abroad, but the amount of total revenue coming from international business was sharply reduced. From 1931 to 1932, Zeiss made nearly sixty percent of its revenue abroad; by 1935, that number was closer to twenty percent and falling.[313]

One of the consistent, if relatively small, sources of international revenue until about 1939 was planetaria and planetaria-related parts and repairs. As mentioned above, planetaria were being purchased and installed in the United States and Western Europe through the end of 1935. In March 1937, a planetarium opened in Osaka; in June, another opened in Paris in the middle of the 1937 World Expo; in late November 1938, a planetarium (purchased in early 1937) opened in Tokyo. This brought the total number of international planetaria to twenty-seven.[314] International sales for planetaria stopped after 1937, but Zeiss maintained an active interest in its most popular planetaria abroad, even

[312] This status quo was sustained throughout the war. Though Zeiss continued to employ Jewish workers several years after most of the country fired them, eventually many of the Jewish employees were deported to camps. Incredibly, at least two Jewish Zeiss employees were still employed at the end of the war with no ill effects.
[313] Data summarized by Walter, 182; also available in BACZ 6485, Carl Zeiss Archives.
[314] The Japanese planetaria, in Osaka and later in Tokyo, are interesting to consider in the context of the increasing friendliness of Japan and Germany during this period; three years later, the Axis alliance would be signed into being.

into the early years of the war. From the late 1930s into the early 1940s, Zeiss published an internal newsletter devoted specifically to planetarium news, called the *Planetariums-Mitteilungen*, and in the annals of this journal we find regular updates about planetaria in New York, Chicago, Los Angeles, and elsewhere well into 1943.

We also find mention of the planetarium in the company's internal newspaper, the *Zeiss-Werkzeitung*, with particular focus on the success of planetaria abroad. In July 1938, for example, a short article tells its readers that:

> We all know, and we are tremendously proud of the fact, that the name Zeiss is famous across the world, and we are always meeting more travelers at home and abroad who associate the name with many wondrous things. […] But even more people than know the name Carl Zeiss know the word "planetarium." The number of visitors of this miracle of German technical genius is today in the millions, with thousands more coming each day.[315]

The planetarium here takes on the role of an ambassador of the Third Reich abroad, reminding international visitors of Germany's technological ingenuity and prowess.

The Jena planetarium itself also played host to a steady stream of international visitors during the early years of the Third Reich. In July 1934, for example, the King of Siam was given a special performance in which Bauersfeld, running the machine himself, displayed the stars above Siam. That same year, a group of French travel agents and photographers stopped for special performance as part of a tour they were completing through Germany. In early 1937, a group of Chilean engineering students came to Jena for a short academic tour, during which they attended a special performance of the planetarium that featured the Chilean sky.[316] In November 1942, the Norwegian Minister for Social

[315] "Das 25. Planetarium wandert in die Welt hinaus!" *Zeiss-Werkzeitung* 13 (2) (July 1938), 14.
[316] Reports of all these visits are contained in ASTRO 0371, Carl Zeiss Archives.

Affairs was given an honorary performance as well, titled "The Starry Heavens from Oslo to the North Pole."[317] The continuing international focus of Zeiss's planetarium operations suggests that well into the Third Reich Zeiss saw the planetarium as a neutral entity, one it could continue to develop independent of the increasingly nationalist and xenophobic German climate. Or rather, they saw the planetarium as a peaceful emissary of the new Germany, spreading the technological wonders of the Reich abroad.

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The 1935 event at the Jena planetarium, where Bauersfeld gave his speech to Ley and other high-ranking party officials, was only one of many occasions in which Nazi party officials and made use of the planetarium space. Jena alone hosted assemblies of party affiliates and military officers throughout the 1930s and early 1940s, and Berlin also received many honored party guests, though records of these visits were lost with the planetarium in 1943 and survive only in occasional mentions in Zeiss memos.

The Deutsches Museum in Munich hosted by far the most party officials of any of the planetaria discussed here, though the museum did not have a smooth transition into the Third Reich. After the Nazi seizure of power, according to historian Elizabeth Vaupel, it "faced a series of attacks and denunciations"; in an effort to mitigate these attacks, von Miller reluctantly agreed to fly the swastika flag at the entrance to the museum in the spring of 1933.[318] Around that time, the city government, which now had a Nazi majority, threatened to cut off the museum's historically free electricity. Furthermore, Hitler rejected

[317] "Sondervorführungen und wichtige Besucher," *Planetariums-Mitteilungen* 13/14 (15 October 1943), 15. BACZ 27343, Carl Zeiss Archives.
[318] Elizabeth Vaupel and Stefan Wolffe, "Das Deutsche Museum in der Zeit der Nationalsozialismus: Revision einer Nachkriegslegender," *Kultur und Technik* 3 (2010), 44.

the position of museum president, an honorary title that had been accepted by every chancellor since 1923. Von Miller interpreted all these together as signs that the museum would very soon no longer receive any material support from the government, decided to step down as head of the museum, appointing Jonathan Zenneck, a moderate party sympathizer and old friend of von Miller's, as his successor. He also appointed the local publisher Hugo Bruckmann (a staunch party loyalist and a relative of von Miller's by blood) as head of the board.[319]

After the war, surviving board members preferred to position their wartime behavior as "apolitical" or gently resisting (much as Bauersfeld did in his postwar account), but, as Vaupel and others have shown, after the initial year of discomfort, the museum embraced its position as a major museum at the heart of Nazi Germany.[320] The museum had always aspired to be a shining jewel in the crown of a major metropolitan center, but as we have seen, Munich's reputation as a cultural destination suffered in the early twentieth century, and the Deutsches Museum was constantly aware of its less-than-desirable position. And while the capital of the Reich remained in Berlin, Munich now enjoyed a cultural status afforded by its historical role as the birthplace of the Nazi movement.

Historians have largely understood this period of museum history as an attempt by the museum to attract and keep the favor of the party. Since 1934, the museum had

[319] It should also be noted that visitor numbers from this period support von Miller's anxiety about the future of the museum. Between 1926 and 1931, annual visitor numbers had hovered steadily between 500,000 and 600,000, but attendance dropped sharply in early 1933, and the museum administration projected an year-total admittance of no more than 300,000. Verwaltungsarchiv 1120/3, Deutsches Museum Archives.

[320] See also Eve Duffy, "Im Spannungsfeld von Selbststeuerung und Fremdbestimmung 1925-1944," in *Geschichte des Deutschen Museums: Akteure, Artefakte, Ausstellungen*, ed. Wilhelm Füßl and Helmuth Trischler (Munich: Prestel Verlag, 2003), 103-148.

attempted to secure the support of Fritz Todt, the official Inspector of German Roadways, by inviting him to curate an exhibition on the construction of the Autobahn.[321] By 1935, after a year of concerted efforts to attract Hitler, the museum opened an exhibit on German Freestone, and Hitler finally paid a visit. He enjoyed himself enough to award a large grant towards Todt's automobile exhibit, and renewed the city's promise of free electricity. In 1937, the museum opened the automobile exhibit, as well as an entirely new annex building for the occasion. The Autohalle was a quick favorite of Hitler, who reportedly said that "I love the car more than anything, for it is the car that opened up Germany to me."[322]

That same year, every Jewish museum member had had their membership revoked, and no Jewish workers remained in the employ of the museum. 1937 also saw the opening of a special exhibit of posters, documents, sculptures, and other graphic media in the library (which had opened in early 1932) called "Der Ewige Jude" (The Eternal Jew). It was one of the most-visited exhibits in the museum's history (nearly surpassing the visitor numbers for the planetarium from 1925-1927). "Der Ewige Jude" was billed as an exhibit of degenerate art and was, when it opened, the largest anti-Semitic collection on display. The choice to use the museum library as the location for the exhibit is interesting; up until "Der Ewige Jude" opened, the library had never been used as an exhibit hall. Furthermore, the museums's post-1933 exhibits, though they were explicitly aimed at attracting the attention and support of Hitler and his party officials, had still been named and advertised as relatively non-political.[323] "Der Ewige Jude," by contrast, was immediately notorious for

[321] Ibid.
[322] Quoted in Vaupel, 52.
[323] They weren't of course; I mean only that the immediately obvious and violently anti-Semitic rhetoric of "Der Ewige Jude" was more radical than the museum's usual fare.

its unabashed, brazen anti-Semitism. With "Der Ewige Jude," the Deutsches Museum firmly aligned itself with the Nazi Party and its ideology; the hesitant acceptance of three years past was nowhere to be found.

The case of the Deutsches Museum's precarious position and its recovery through the wooing of Hitler and his subordinates points to a larger body of scholarship concerned with the peculiar relationship of Nazis and technology. As John Guse has shown, the Nazi relationship to technology tended to privilege engineers over scientists, and it is unsurprising that the Deutsches Museum, with its long-stated goal of establishing a canon of German engineering, would thrive.[324]

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Nazi involvement in planetaria during this period took two routes. The first was ceremonial events for party officials, like the 300 officials who came to Jena in 1935. Jena in particular regularly recorded visits from party members, although not usually in as ceremonial a style as the 1935 visit. Berlin also occasionally reported back to Jena about military officers who came for special performances, though the details of most of those visits have been lost. The Deutsches Museum planetarium as well regularly received party visitors, though these visits were folded into larger museum trips and were never extensively documented.

The second genre of official interactions with planetaria were relationships with the recently re-formed military. After the Nazi seizure of power, the Reichswehr (the

[324] I am thinking here both of Jeffrey Herf's seminal book on *Reactionary Modernism*, but also Jonathan Guse's reexamination of the same thesis in his study of Todt's "Special Train of German Technology" tour of rural Germany. See John C. Guse, "Volksgemeinschaft Engineers: The Nazi "Voyages of Technology," *Central European History* 44 (3) (September 2011), 445-477.

Versailles-approved defensive force) was gradually transformed into an offensive power, with many more soldiers than the Treaty of Versailles had authorized, and a mandatory oath of fealty to Hitler. In early 1935, Hitler renamed the force the Wehrmacht, and began serious armament preparations. The Luftwaffe, the Air Force, was also officially reestablished at this time.

In March 1938, an Aerospace Engineer from the Luftwaffe travelled down to Jena from the Luftwaffe experimental training ground in Rechlin (a small town northwest of Berlin) to meet with Bauersfeld about the possible construction of a miniature version of the Mark II planetarium projector. The Kleinplanetarium, as Bauersfeld called it, had been in various stages of production for several years, but there had never been a demand, and so a complete model had never been built. With the Luftwaffe's new interest and a promise of 13,000 RM, Zeiss began production on the design.

The Kleinplanetarium requested by the Luftwaffe was basically a scaled-down version of the Mark II model installed in most of the full-scale planetaria at the time. It required a dome diameter of only four to six meters (the typical diameter of a full-sized dome was 20-25 meters), and used significantly fewer projectors. While the Mark II used more than eighty projectors for stars alone, the Kleinplanetarium used only thirty-one. It also had one projector each for planets out to Saturn, the moon and sun, as well as clear lines for the equator and the ecliptic, and the milky way. The small projector used a combination of electric motors (for the usual rotation of the sky) and handcranks (to change the precession of the Earth, for example).[325] The planetarium and its dome were also

[325] "Beschreibung des 'Klein-Planetariums,' no date, BACZ 27432, Carl Zeiss Archives.

relatively mobile; the dome could be disassembled with relative ease, and the small projector could be packed up to move wherever it next needed to go. Zeiss managed a working model by late May 1938, which an engineer brought up to Rechlin for testing by the head aerospace engineers at the base. The Luftwaffe formally adopted the Kleinplanetarium in the summer of 1938, and used it at least through late 1943.

The purpose of the Kleinplanetarium was to train test pilots in celestial navigation, a skill with which all Luftwaffe pilots technically had to be functionally familiar. The goal of the Kleinplanetarium was to give pilots a fully immersive environment in which to test their skills. During this period, at least two Kleinplanetarium were manufactured for the Luftwaffe, though both were destroyed in the war.[326]

Members of the Luftwaffe who were not stationed at Rechlin also occasionally encountered planetaria; reports from Berlin throughout the late 1930s and early 1940s mention groups of pilots attending special shows on celestial navigation in the larger dome.[327] Jena recorded similar visits throughout this period.

In February 1941, a crew of submarine sailors came to the Jena planetarium for a special performance that was commemorated in a series of short articles.[328] [*Figure 5.5*] The trip was arranged for the crew as a special reward after some particularly daring maneuvers during the long-running Battle of the Atlantic. The special performance was hosted by Bauersfeld himself, who first gave the sailors a historical overview of the planetarium, explaining its origins in the imaginations of von Miller and his friend Wolf,

[326] Ibid.
[327] See BACZ 3100, Carl Zeiss Archives.
[328] "U-Boot-Fahrer besuchten das Zeiß-Planetarium," *Zeiss-Werkzeitung* 16 (2) (April 1941), 44.

and how it was fully realized at the hands of the Zeiss company engineers. He also ran the projector through its paces, while explaining how it could be used as a teaching tool for stellar navigation. The association of the planetarium with a reward is interesting; Bauersfeld's emphasis on the historical context of the planetarium is also telling. By framing the demonstration of the planetarium's practical uses for navigation with a narrative of its invention that highlighted the creative genius of its creators, Bauersfeld explicitly contextualized the planetarium as above all a German invention.

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Alongside these special occasions, we find a steady stream of scheduled performances at planetaria well into the 1940s. Furthermore, admission records for all German planetaria show that every planetarium recorded consistent or increasing attendance. Jena and Stuttgart recorded dramatically increasing numbers through 1937, while the remaining nine recorded steady admission rates.[329] In fact, it seems that nearly every German planetarium remained in operation through the war, until the very last years, when many were destroyed in Allied bombings (as is the case with Munich, Berlin, Mannheim, Stuttgart, Hannover, Vienna, Barmen, Dresden, and Leipzig), or suspended operations (as in Hamburg, Düsseldorf, and Jena itself).

A cursory look at planetarium shows offered in this period suggests a spectrum of genres offered. Some were focused on specific astronomical phenomena – "The Temperature of the Sun," for example – or studies of specific planets, like "Mars and

[329] "Statistiken zu den Gesamtbesucherzahlen der Z-P im In-und Ausland, Zeit: 1924-1937," BACZ 27439, Carl Zeiss Archives.

Jupiter," or "The Moon, Jupiter, and Saturn."[330] Occasionally, special phenomena would warrant special shows; the 1938 total lunar eclipse, for example, was heralded in Jena by a two-day series of planetarium shows devoted to explaining the process of a lunar eclipse, and, by way of a special color filter added to the moon projector on the device, recreated the color effect of the eclipse.[331]

Shows would also celebrate a specific event. A popular Jena show from 1940, for example, commemorated the 1934 South Pole attempt of Richard Byrd.[332] It's unclear why the Byrd show was written when it was, though it's possible it was meant to coincide with Byrd's arrival in Hamburg in late 1938, where he was invited to participate in an Antarctic expedition to find New Swabia. New Swabia, or *Neuschwabenland*, was something of a military fixation in the late 1930s. Hermann Göring authorized a 1938 exploratory mission to a northern region of Antarctica, which had previously been explored by Germans in 1903. The ostensible goal of the mission was to scout a location for a whaling station, but researchers at the Scott Polar Institute of Cambridge have shown that Göring also intended the expedition to scout for a possible secret military base.[333] Byrd declined the offer to participate in the expedition, but the mission continued.

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[330] "Berlin: Tägliche Kurzvorführungen," *Planetariums-Mitteilungen* 6 (15 January 1941), 1. BACZ 27343, Carl Zeiss Archives.,

[331] Report in "Sonderveranstaltungen im Zeiss-Planetarium zu Jena während des Winterhalbjahrs," BACZ 3100 Carl Zeiss Archives.

[332] "Sondervorführung: Mit Byrd unter dem Sternenhimmel der Antarktis," *Planetarium-Mitteilungen* 6 (15 January, 1941), 6. The Byrd show was possibly written in honor of Byrd's arrival in Hamburg in late 1938, where he was invited to lead an Antarctic expedition to find New Swabia, though he declined.

[333] See Colin Summerhayes, "Hitler's Antarctic Base: Myth and Reality," *Polar Record* 43 (2007), 1-21; and David Thomas Murphy, *German Exploration of the Polar World: A History: 1870-1940* (Lincoln, NE: University of Nebraska Press, 2002).

The Byrd planetarium show might then be understood in the context of this colonial fixation on Antarctica as a strategic new resource and defense station. The planetarium show of course does not address the attractive logistical qualities of New Swabia, but it asks visitors to imagine themselves there on the frozen tundra along with Byrd. It begins by showing the sky over Boston, where Byrd prepared for his 1934 expedition, and as the narrator spins a tale of Byrd's journey south, the planetarium projector slowly tips over, until, as Byrd crosses the equator in the story, the southern hemisphere of stars is fully visible. Finally, the narrative and the projector both arrive at the South Pole, and visitors are treated to an explanation of how the appearance of stars operates at a pole. The verisimilitude of the experience was supported by an ingenious use of filtered light to produce the effect of the *aurora australis*, the Southern Lights. The show weaves a fantasy that is essentially colonialist – asking visitors to imagine themselves standing on New Swabia, discovering the southern sky. As a final touch, audience members were also treated to a recording of Beethoven's fifth symphony as the narrator read excerpts from Byrd's travel diary. As the *Jenaische Zeitung* put it, "the presentation cannot help but leave every visitor with an indelible impression."[334]

The use of music in the Byrd show was one of the early examples of a new audio technology Zeiss began to install in planetaria starting in the late 1930s. Zeiss began offering a turntable addition to the lecture stand usually installed in the northern quadrant of the dome, with speakers installed at the very peak of the dome, mounted to the metal frame behind the cloth interior lining. The effect, reported the engineers, was that sounds

[334] Ibid.

coming from the apex of the dome "filled the room like 'the Harmony of the Spheres,' with sound coming from no discernable direction."[335]

The turntable installation included ten pieces that the Zeiss engineers felt could be played "to create a tremendous impression" at both the beginning and conclusion of planetarium performances.[336] The list included Bach's Toccata and Fugue in D-minor, Händel's Largo from *Xerxes*, Grieg's "Morgenstimmung," and several Beethoven excerpts (Adagio from the Moonlight Sonata, "Heil'ge Nacht, o gieße du," the overture from *Prometheus* and the Eroica). The most modern selections were three excerpts from Richard Wagner ("Karfreitagszauber" from *Parsifal*, "Heil dir Sonne, Heil dir Licht!" from *Siegfried*, and "Wach auf, es nahet gen den Tag," from the *Meistersinger*).[337]

It is well-known that Wagner was Hitler's favorite composer. Wagner's obsession with Nordic and ancient Germanic myths was rooted in a passionate nationalism and a deep anti-Semitism. He was particularly taken with the figure of "Der Ewige Jude" – the eternal, wandering Jew, doomed to roam the earth untethered from a nation and unmoored from morality. Wagner saw Jews as the quintessential threats to a German sovereignty rooted in the land, and we find the Wandering Jew as a character trope in many of his operas – *The Flying Dutchman*, most famously. Wagner's music was well-loved by Hitler and featured prominently in many Nazi party events and ceremonies, and its inclusion here in a list of suggested musical accompaniments points to Zeiss's awareness and embrace of this trend.

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[335] "Musikalische Umrahmung von Planetariumsvorführungen," *Planetariums-Mitteilungen* 1 (15 January 1940), 6. BACZ 27343, Carl Zeiss Archives.
[336] Ibid, 7.
[337] Ibid.

This musical repertoire is only one example of Zeiss's embrace of specifically German cultural touchstones in their planetarium material from this period. We see an echo of this in a list of suggested "inspirational quotes" to be read during planetarium performances.[338] Here we find Schiller (an excerpt from "Die Größe der Welt"), Friedrich Rückert (from "Weisheit des Brahmanen"), Nietzsche (from *Also sprach Zarathustra*), Gottfried Keller (from "Herbst"), Klopstock (from "Psalm"), and, unsurprisingly, many excerpts from Goethe. The bulk of the suggested Goethe quotes are drawn from *Faust* (specifically the prologue in Heaven) and the poem "Das Göttliche."[339] The excerpts range from reflections on the beauty or profundity of the heavens (Rückert: "O, lift your gaze, when the world tries to confuse your spirit, to the heavens, where the stars never stray") to more specific subjects. From Keller's "Herbst," the writers have suggested a line on an old Norse constellation, a great wagon: "Heerwagen, most mighty of all the constellations of the Germanic peoples!"[340]

As has been shown already in Chapter 2, Zeiss was preoccupied with its role in the historical legacy of German romanticism. These musical and literary selections represented an increased effort to contextualize the planetarium as part of a German cultural heritage. The excerpt from Keller is also indicative of an increasing interest in tracing German cultural lineage further back than just the Romantics – back to the "Altgermanen," the ancient Nordic race from whom modern Germans were said to have descended. For Zeiss,

[338] "Geeignete Zitate für Planetariums-Vorträge," *Planetariums-Mitteilungen* 3 (15 April 1940), 7-8. BACZ 27343, Carl Zeiss Archives.
[339] Ibid, 7.
[340] Ibid.

this interest manifested itself in a series of performances concerned with tracing the *altgermanisch* constellations.

An early example for examining this shift more closely is the 1938 series of shows designed specifically for children at *Heimschule*, the government-funded boarding schools that sprang up across Germany after 1936. The theme of the course was "The Starry Skies Above You," (an indirect reference to Kant), and includes four individual shows. These cover a variety of simple astronomical concepts, from the movement of the moon and planets, to the basics of celestial navigation and the astronomical basis of the calendar system. One of the performances, "The Constellations of the Homeland Sky," is designed to teach the basics of constellations and how to recognize them, but crucially, this performance does not teach the classic Greco-Roman constellations; instead, students learn old Norse constellations, like the "Great Wagon."

This performance was a revision of the classic "Die Himmel der Heimat," but the change from Greco-Roman constellation outlines to entirely different Old Norse constellation images made it a dramatically different show. Rather than simply orienting students under a new sky, the use of Old Norse constellations introduces students to a new cosmology, a specifically German one.[341]

Several histories of the "altgermanisch" people were published in the late 1930s, most notably Dutch linguist Jan de Vries's *Altgermanische Religiongeschichte*, published

[341] It must also be noted here that very little documentation exists about what the old Nordic constellations actually were. Scholars generally agree that the Wagon (sometimes called the Man's Wagon, or the Heerwagon [the military wagon]) was what we recognize as Ursa Major, and "Asar Battlefield" is probably Auriga, the charioteer. The Milky Way was also known as the Road of the Dead. Others, like Aurvandil's Toe, remain more of a mystery.

in 1935 and widely circulated among German academics. Though de Vries himself was skeptical of the Nordic Race theory, his scholarship was widely read by many who took his historical account of old Germanic myths and cultural traditions as evidence of Germany's racial lineage. Zeiss also appears to have drawn on the work of two Jena-based scholars of the subject: Otto S. Reuter and his work on "Germanic Astronomy," and Gotthard Neumann, the director of the Germanic Museum in Jena.[342] Both Reuter and Neumann were enthusiastic party members, with Neumann joining the NSDAP Teacher's Union in 1933 and Reuter paying full membership dues by 1939.

Both Reuter and Neumann devoted their scholarship to the study of Germanic religion and culture in efforts to establish the historical origin point of the Germanic peoples, and to trace a clear cultural lineage to the present. Central to this for both was an effort to decipher old Norse cosmological texts, and they shared much of their research with Zeiss. Zeiss designed several shows in this period that explored the sky of the old Teutonic people that played in planetaria across Germany, but none reached the success of the show "Schein und Sein im Wandel der Planeten" (Appearance and Being in the Movement of the Planets).

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In late May 1938, another large assembly of people congregated outside the Jena Planetarium, decked out in formal brown party uniforms. This crowd featured not just high-ranking local party officials, but also the mayor of Jena, the president of the university, and

[342] The Germanic Museum was actually the early history collections of the University, housed on University grounds. The name "Germanisches Museum" was given the collection in 1863, and lasted until 1945. After the war the collection was renamed the "Preshistoric Museum."

the Thuringian educational minister, along with several dozen more humble men, employees of Zeiss and local school teachers alongside members of the press.

This occasion was another planetarium show, but unlike the 1935 performance, which was largely devoted to a demonstration of the machine and bookended a larger celebratory event for the party, this event was devoted exclusively to the planetarium. It was the eve of the machine's 25th birthday (counting, as Zeiss did, from Wolf and von Miller's 1913 brainstorm), and Bauersfeld and Helmut Werner (who replaced Bauersfeld as head of the planetarium division after Bauersfeld received a promotion) had designed a brand new show, collaborating closely with Reuter and Neumann in writing the script for the performance.

"Schein und Sein" was one of the more theatrical presentations produced by Zeiss at the time. The show begins with the room in total darkness, and as the projector lights are slowly brightened, and the stars appear, the narrator sets the scene:

> We see above us a wholly new and unrecognizable sky. The stars appear to turn not around our well-known north star, Polaris, but around a smaller star in Camelopardis. And more strange even than this, the point at the center of all this rotation is very nearly right above our heads! Here we are, in the year 800 AD, north of the Arctic Circle, at one of the northernmost tips of the habitable Earth. We are standing here on the northern coast of a small island; it is where overwhelming evidence suggests that the culture of the ancient Germanic peoples began.[343]

The script of "Schein und Sein" alternates between explanations of scientific phenomena – why the sun above the Arctic Circle never rises in the winter, or never sets in the summer, for example – and dramatic historical narrative that asked visitors to

[343] "Schein und Sein im Wandel der Planeten: Ein Sternvorführung im Zeiss-Planetarium," ASTRO 910/112, Carl Zeiss Archives.

imagine themselves as ancient stargazers themselves. [*Figure 5.6*] In particular, visitors are placed in the shoes of Oddi Helgason (also known as Star-Oddi), an 11th-century farmer whose detailed written astronomical observations served as the main reference point for contemporary scholars to piece together Norse cosmology.

The most dramatic element of this performance came near the end. Throughout the show, the projector had lazily spun, continuing to project skies from the late ninth century north of the Arctic Circle. The third act of the performance, after the dramatic opening and central section focused on Oddi and his astronomy, focuses on constellations. All Zeiss projectors (with the exception of the Kleinplanetarium) were equipped with a secondary apparatus that projected artistic renderings of all the constellations onto the sky. For this performance, Zeiss actually manufactured a limited run of another constellation overlay projector.

Near the end of the show, the lecturer would turn on the usual projector, showing the familiar Greco-Roman constellations. He would gradually fade out the traditional constellations, and then, as the finale from Wagner's *Götterdammerung* (Twilight of the Gods) played on the new phonograph, broadcast over the newly installed speakers, the lecturer would slowly turn on the new constellation projector. Instead of the recognizable standards of the Arctic sky in spring – Ursas Major and Minor, Cassiopeia, Cancer, Draco – an entirely unfamiliar cast of characters appeared. Instead of Ursa Major and Ursa Minor, two wagons appeared – the Wodan's Great Wagon, and his wife Frigga's smaller wagon behind him. Instead of Castor and Pollux, the eyes of the evil giant Thiazis. There were also new constellations that did not correspond to recognizable areas, like Fenrir the Wolf,

or Thor's Hammer, or the Toe of Aurvandil.[344] As the new night sky appeared, the lecturer reads from the apocalyptic vision of the "Völuspá," the first in the old Norse collection of epic poems called the *Edda*, in which a seer gives a vision of Ragnarok, the end of the world:

> Much do I know, and much more do I see
> Of the fate of gods, of the mighty in battle
> […]
> The sun turns black, earth sinks into the sea
> The blazing stars down from heaven are thrown
> Fierce billows the steam and the life-feeding flame,
> Until the fire leaps high, and reaches Heaven itself.[345]

The entire affair was shockingly apocalyptic, especially the combination of the Völuspá excerpt and the recording of Wagner's *Götterdämmerung* finale, in which the flames from Siegfried's funeral pyre engulf the halls of Valhalla. The effect of the show was tremendous. The *Thüringer Gauzeitung* wrote that the show was a "vision [*Traumbild*] of fantastic intensity that spilled out over all who were present, and pulled them under the spell of the myths of our ancestors."[346] The *Leipziger Neuesten Nachrichten* wrote that the show "wove a spell of marvelous fantasy."[347] Another commentator from the *Thüringer Gauzeitung* took a more academic tone when they noted that the show would be an "important new addition to the discussion about the cultural history of our ancestors," and

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[344] "Schein und Sein," 27.
[345] This translation is a combination of my own translation of the German excerpted in the show script and a modern English translation of the "Völuspá" that I found on www.voluspa.org. It's a very detailed translation that matched the poetic mood of the German from the planetarium lecture, though that also managed to rhyme.
[346] "Das 25. Zeiss-Planetarium fertiggestellt: Feierstunde der Zeiss-Kamaraden," *Thüringer Gauzeitung* (3 May 1938), in CZO-AS 459, Carl Zeiss Archives.
[347] "Das 25. Zeiss-Planetarium," *Leipziger Neuesten Nachrichten* (5 May 1938), in CZO-AS 459, Carl Zeiss Archives.

that it performed an essential education function, in making "our ancestral history" visible and understandable to audiences.[348] For this author, "Schein und Sein" did not only astound and amaze, but it fulfilled an ethical obligation to teach Germans about their own mythic history. "Schein und Sein" was a dramatized vision of what Bauersfeld spoke of in front of the long-serving party officials visiting the planetarium in 1935 – an explicit demonstration of the inevitability of the German nation, so inevitable, in fact, that its fate was literally written in the stars.

How does the planetarium fit into the larger landscape of Nazi thought? Jeffrey Herf has shown that Nazi ideology was not as hostile to technology and technological advancement as its irrational, anti-modern bent would suggest; rather, Nazi thought embodied what Herf called "reactionary modernism," which romanticized certain kinds of technology while demonizing others that it associated with urbanism and capitalist excess. John Guse has complicated this picture by showing that the specific kind of romantic reactionary modernism Herf observed was really only embraced by some.[349] While those who have considered the question of the planetarium in the Third Reich have generally assumed the planetarium either stagnated or actively suffered as a result of a deep Nazi aversion to technology, my research has shown that the planetarium actually fit quite naturally into the landscape of Nazi thought. Not only was it practically useful, as the requests for a Kleinplanetarium by the Wehrmacht show, but it was also celebrated, both for the visions it could produce, and for what the machine itself represented.

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[348] "Zeiss Planetarium im Dienst der Kulturgeschichte

[349] John C. Guse, "Nazi Technical Thought Revisited," *History and Technology* 26 (1, March 2010), 3-38.

CONCLUSION

Nearly all the planetaria featured in this dissertation no longer exist, or at least no longer exist in their original form. Most of the German planetaria of the interwar period, located as they were in the centers of cities, were utterly destroyed by Allied bombings late in World War II. While some, like Jena's, suffered minimal damage, most were either reduced entirely to rubble during the bombings themselves, or were so structurally unsound that they were demolished quickly after.[350] The Deutsches Museum as a whole was heavily damaged; the most severe destruction occurred in the astronomy department, and both the Ptolemaic and Copernican planetaria were crushed by the collapsing roof, though overall nearly eighty percent of the museum was destroyed.

The Berlin planetarium was hit by a shell during the 1943 Battle of Berlin that also destroyed most of the Zoo and the area around the Kaiser Wilhelm Memorial Church. This neighborhood had been the epicenter of the bright, flashy freedom of the Weimar period, and its reduction to rubble became symbolic of the damage – emotional as much as physical – wrought by the conflict. The bombing had been particularly destructive to the Zoo; most of the western half of the grounds was destroyed and all the animals killed, while many exhibits further to the east had been so damaged that animals wandered freely amid the rubble. Sensationalist papers warned of bears roaming the streets, and while no records of bears on the loose have been found, zookeepers reportedly had to track down several

[350] Jena was, in fact, nearly the only one that remained standing (Hamburg and Dusseldorf are the others). All other German planetaria, as well as the one in Vienna, were reduced to rubble by 1945.

wayward monkeys.[351] The planetarium, located so conveniently near the train station and the Elephant House on the western edge of the property, went up in flames.

When the conflict ended in the spring 1945, nearly all the planetaria of the Weimar period were gone. As Germany as a whole began to rebuild, none of the destroyed free-standing planetaria were replaced with new buildings. While the Deutsches Museum was rebuilt with some alacrity, reopening in mid-1948, neither planetarium had been replaced.[352]

Part of the reason for this was the gutting of the Zeiss corporation that began in the late spring of 1945 and ended in early 1947. The company headquarters had not been irreversibly damaged during the last months of the war, but all production was frozen by the American occupying forces when they entered the city in April 1945. While at the headquarters, the American troops took patents, designs, production equipment, and engineering staff. This requisitioning took place alongside the more secretive Operation Paperclip initiative, in which the US collected German scientists working mostly on rocketry, satellites, and nuclear research (most notably, those scientists working under Werner von Braun at Peenemünde). But the US project of collecting German scientists extended beyond these main areas of focus, and the Zeiss headquarters were a goldmine of optical engineering talent.

After the American occupying forces were replaced by Soviet troops later in 1945, the Zeiss headquarters were further stripped. The Soviets' version of Paperclip, Operation

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[351] Gary Bruce, *Through the Lion Gate: A History of the Berlin Zoo* (Oxford: Oxford University Press, 2017), 197.

[352] The Ptolemaic planetarium was replaced in the early 1960s with a Mark IV, but the Copernican planetarium was never rebuilt.

Osoaviakhim, was an intensive and nearly violent requisitioning of German scientists across the Soviet occupied zone, focusing largely on rocketry and on the Zeiss headquarters. By early 1947, less than a fourth of Zeiss's manufacturing equipment remained in Jena, and many of its engineers were gone.

To compensate, a secondary Zeiss location in Heidenheim, to the west, which had been less damaged and gutted, increased its manufacturing capacity and founded a new headquarters, called Zeiss-Opton Optische Werke Oberkochen. When Germany was officially split in 1949 between the Soviet territory to the east and the Allied territory to the West, forming the Deutsche Demokratische Republik and the Bundesrepublik Deutschland, Oberkochen became the official West German Zeiss company, and Jena became the East German headquarters. They operated basically as two separate companies during the separation, though much of their principle manufacturing remained the same. Walter Bauersfeld relocated most of the planetarium team to Oberkochen, bringing with him most of the blueprints and schematics for the Mark II and the Kleinplanetarium projectors.

By 1950, Zeiss-Oberkochen began planetarium manufacture again, and quickly updated the Mark II design with a newer motor, calling it the Mark III. The first Mark III projector was sold to the city of San Paolo, Brazil, in 1953. Bauersfeld's team then developed the Mark IV, which was largely the same but with slightly different manufacturing materials and more accurate diurnal motions, and sold the first of the Mark

IVs to Tokyo in 1957. Zeiss-Jena, meanwhile, continued to manufacture the Mark II model, and gave its first post-war projector to Stalingrad in 1954.[353]

The first post-war planetaria from both Oberkochen and Jena went abroad; no German cities bought them until the early 1960s, when the Deutsches Museum replaced its Ptolemaic Planetarium with a Mark IV from Oberkochen. One of the first cities to order one was West Berlin, which received its new Model V (again, a marginally updated version of Model IV) in the fall of 1965.

In the intervening two decades, the Zoo had been both rebuilt and expanded, swallowing up the empty planetarium plot and replacing it with a peacock aviary. When the city of West Berlin was considering a new location, they did not look to the Zoo or the surrounding Tiergarten; they did not, in fact, look anywhere near the Kurfürstendamm area at all, which by 1965 had been largely rebuilt. Instead, the city officials tasked with finding a new location for the planetarium looked to the south, to the neighborhood of Schöneberg, west of the Tempelhof Airfield and south of Nollendorfplatz. Schöneberg had historically kept pockets of artists and bohemians during the Weimar Republic – near Nollendorfplatz, famously, was the queer district frequented by Christopher Isherwood and others – but the area chosen by the city was far quieter and more remote. They chose the Insulaner, a newly made verdant hill crafted out of a towering pile of rubble (a *Trümmerberg*).

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[353] The immediate post-war period also saw the rise of the first real Zeiss competitors; before the war, Zeiss had been the only planetarium on the market. In 1948, however, Armand Spitz (an amateur engineer and professional journalist from Philadelphia) advertised his portable Spitz planetarium, a table-top-sized device priced at $500 – a staggeringly low price compared to the Zeiss projectors (the Spitz device, of course, had no dome with it, and achieved a fraction of the clarity and accuracy of the Zeiss projectors). Spitz soon began developing large-scale dome planetaria. Other planetaria were manufactured around this time as well – most notably, the one built in the machine shop of the California Academy of Sciences – but Spitz was the first to truly emerge as a competitor for Zeiss.

Three years previously, in early 1962, the Insulaner had become home to a new observatory, named after the founder of the Berlin Urania, Wilhelm Foerster. The Wilhelm Foerster observatory was modest, thought its star telescope was the five-meter Bamberg Refractor purchased by Foerster for the original Urania. The Foerster observatory was the meeting place of the Wilhelm Foerster Society, formed in 1949 and dedicated to the popularization of astronomy for the people. The city of Berlin chose the Insulaner not simply as a quiet, out-of-the-way spot; the planetarium was to complete the observatory's public offerings, to become an additional way for the Society to teach science to the public.

The relocation of the planetarium from the bustling cultural center, where its neighbors were elephants, trains, and cinemas, to a remote park where it became part of a collection of astronomical apparatuses exemplifies the overall shift in planetaria in the postwar period. The planetaria in the Weimar Republic were sites in which conflicting visions of German identity and German landscape could be explored. Even in shows dedicated to astronomical pedagogy, the emphasis was always on orientation, on relating the motions of the heavens to life in the city. In the planetarium literature of the period, we see again and again the anxiety that man has lost touch with the stars by living in overwhelming, overstimulating city centers, and the task of the planetarium is to bring man back into alignment with his natural landscape, even if the natural world is unreachable. The goal of the planetarium's education is not, in this view, to inspire dreams of space exploration or astronomical study, but to orient, to reassure, to reaffirm modern man's place in the cosmos. Even when the planetarium was celebrated for its astounding, dizzying

feats of illusion, the emphasis was not on its depiction of outer space so much as it was on the sensations produced by the spinning, swirling stars.

The postwar planetaria were radically different. If the pre-war planetarium was a site for reaffirmation and astonishment, the postwar planetarium was a site for imagining outer space as a *place* – a place to explore, to occupy, and use. Planetaria began reappearing across Germany, but most were no longer free-standing attractions in city centers; far more often, they were connected with new science centers and observatories.[354] Those that remained free-standing added astronomical exhibits to their entryways and hallways; instead of the deliberately spartan halls of the pre-war structures, post-war planetaria were filled with miniature science museums.

In sum, the postwar planetaria in Germany were no longer concerned with Germany itself; instead the focus was on space. This interest was only intensified as the Space Race accelerated in earnest. I plan for future research on this subject to consider more carefully the distinction between planetaria in East and West Germany – their shows, their architecture, their reception – to understand the role they played in the ideology of the Cold War in Germany. For now, it is enough to observe that planetaria experienced a redefinition in the postwar period – the relocation of Berlin's to a science center away from the center of the city is a concrete embodiment of this shift.

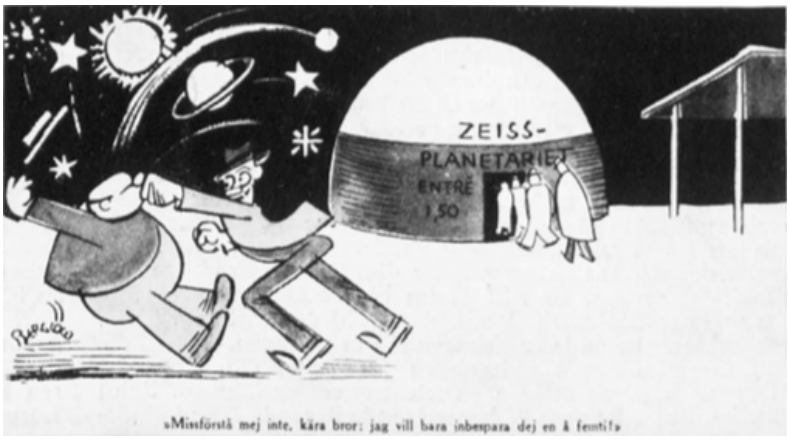
The planetarium in pre-war Germany served as a site for a number of different fantasies and anxieties to be navigated. Within the confines of the dome, the planetarium indulged fantasies of far-flung travel, both in space, hurtling from pole to pole and

[354] Not all, of course. The 1987 East Berlin planetarium, the last built by Zeiss-Jena before reunification, stands alone in the Ernst-Thälmann Park in Prenzlauer Berg.

hemisphere to hemisphere, and in time, spinning thousands of years ahead or behind. It constructed worlds that imagined new conquests and reified nationalist mythologies. It produced a dizzying, looping world "better," as one visitor wrote, "than any cinema."[355] The planetarium emerged as an evocative site of experience that, in the words of one anonymous account, "is so far above the merely informative that it approaches the uplifting. And, ironically, it is also somewhat unearthly. It makes you feel successively, like an ancient philosopher, the weather man, and God."[356]

[355] Tolischus, 97.
[356] "Heavenly Adventures," *Vogue*, December 15, 1935.

IMAGES



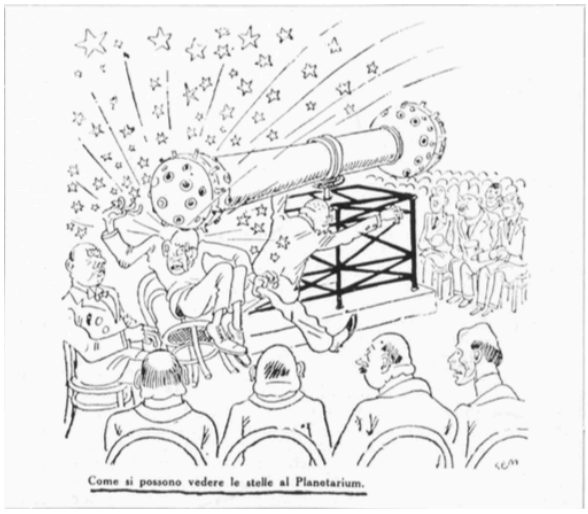


Figure 1.1. Planetarium humor
Courtesy Carl Zeiss Archives.

Figure 1.2. Invited guests await the opening of the Zeiss planetarium prototype on the roof of the Carl Zeiss Company in Jena, September 1923. Courtesy Deutsches Museum Archives.

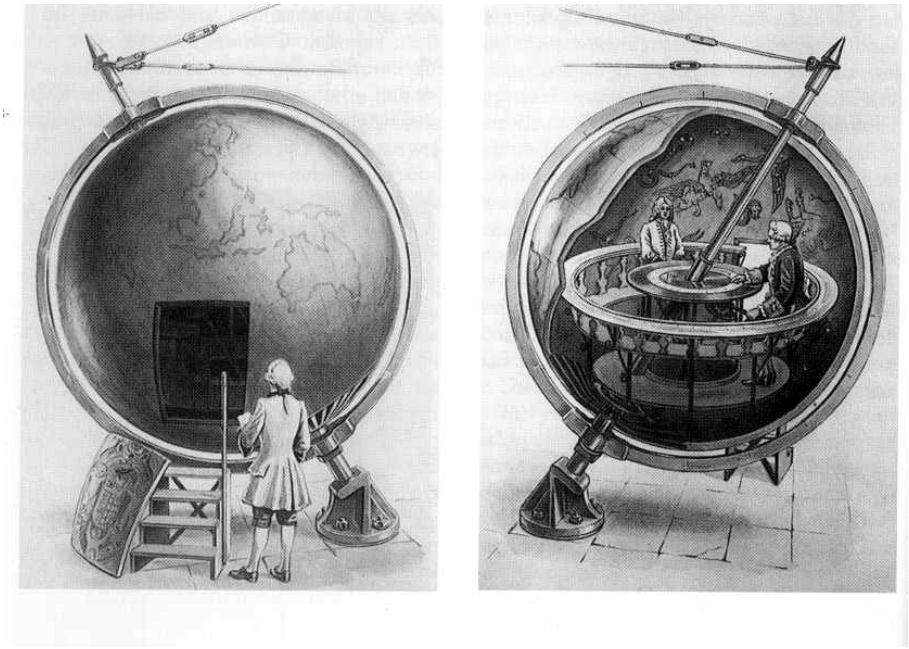


Figure 1.3, above The Gottorp Globe. Courtesy Gerhard Hartl, Deutsches Museum Archives.
Figure 1.4, below The Eise Eisinga Orrery, with sun and inner planets in use. Courtesy Wikimedia Commons.

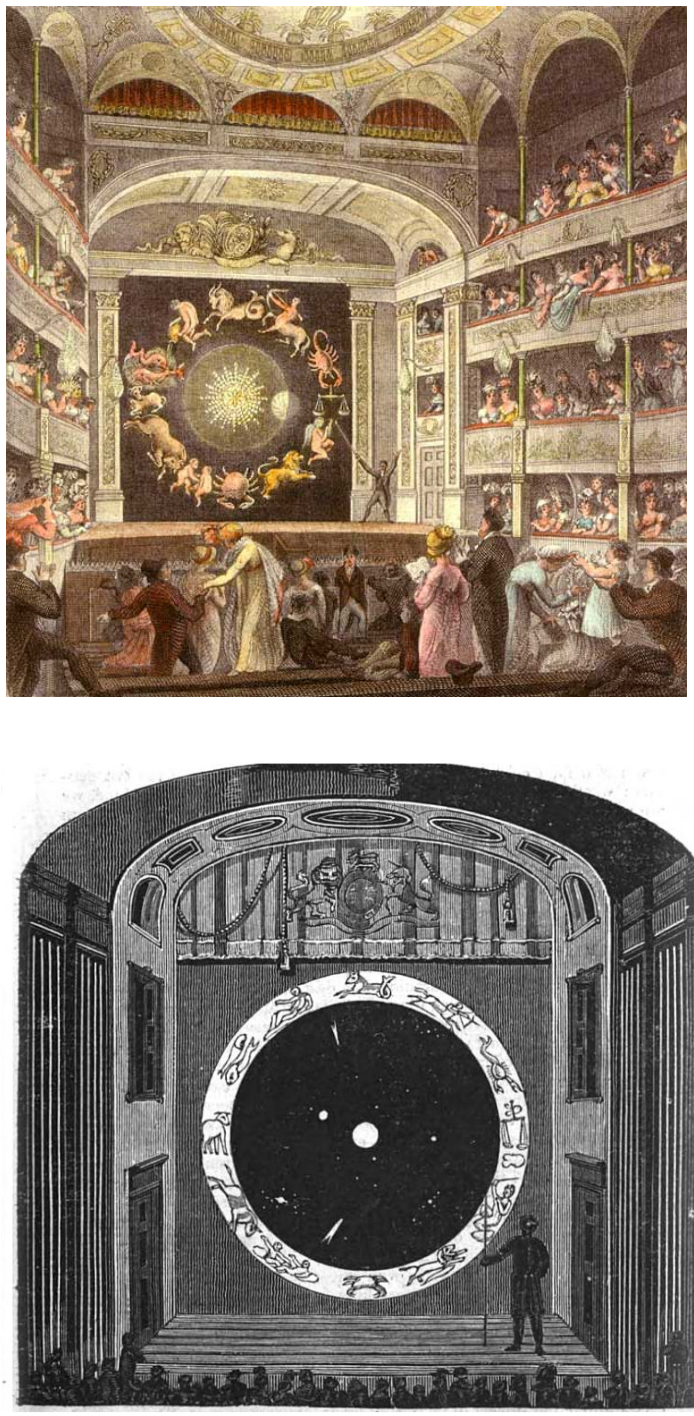


Figure 1.5. The Eidouranion Orrery displayed at theLyceum Theater, with Adam Walker giving the lecture. Both images courtesy of Wikimedia Commons.

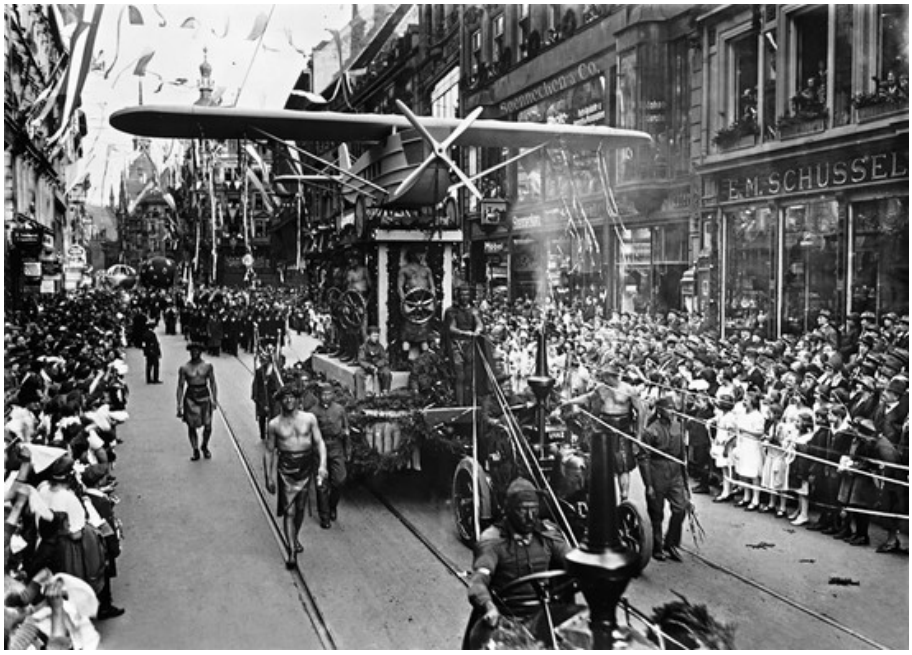
CHAPTER I - The Temple of Glory

Figure 2. Crowds assembling at the front doors of the Deutsches Museum, awaiting its first opening on May 7, 1925. Courtesy Deutsches Museum Archives.

Figure 2.2, above. 1928 painting of Museum building from west bank of the Isar River. **Figure 2.3, below.** 1938 photograph of Museum Island. The low rectangular building in front of the original building is the library, completed in 1932. The building to the fore of the library is the Autohalle, built in 1935 at Hitler's request.
Both images courtesy Deutsches Museum Archives.

Figure 2.4. Kaiser Wilhelm, left, and Oscar von Miller, right, touring the construction grounds of the Deutsches Museum on Kohleninsel, 1913. Courtesy Deutsches Museums Archives.

Figure 2.5, above. Electricity float at the Deutsches Museum opening parade, 5 May 1925. **Figure 2.6, below. A**viation and steam float, pulled by small steam engines and flanked by be-sooted men. The motif of the wheel evokes both the steering wheel of the steam-powered automobiles and also the symbol of the museum, which is an owl sitting atop a gear wheel. Both images courtesy Deutsches Museum Archives.



Figures 2.7, above, and 2.8, below. Historical floats at the Deutsches Museum opening parade, 5 May 1925. Images courtesy Deutsches Museum Archives.

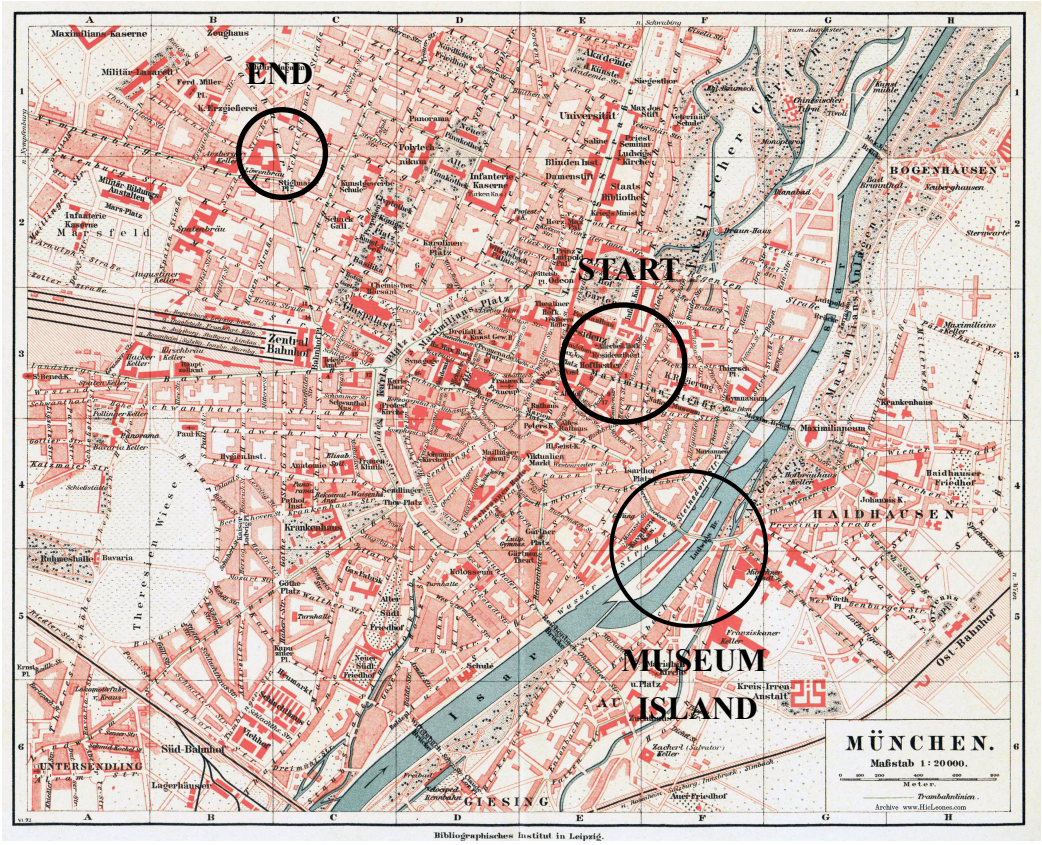


Figure 2.9 Map of Munich, c. 1920. Start and end of parade are marked, along with Museum Island. Courtesy Staatsbibliothek Berlin.

Figure 2.10. Oscar von Miller as the monk of Munich, in a cartoon in a Berlin pamphlet. Courtesy Deutsches Museum Image Archives.

Figures 2.11, above. Conceptual sketch of the *Ehrensaal*
Figure 2.12, below. Photograph of *Ehrensaal* a week before opening.
Both images courtesy Deutsches Museum Archives.

Figure 2.13 Tischbein's portrait of Goethe in the Roman Countryside (1787), a print of which hung above the doorway leading from the Ehrensaal to the rest of the museum. Courtesy Wikimedia Commons.

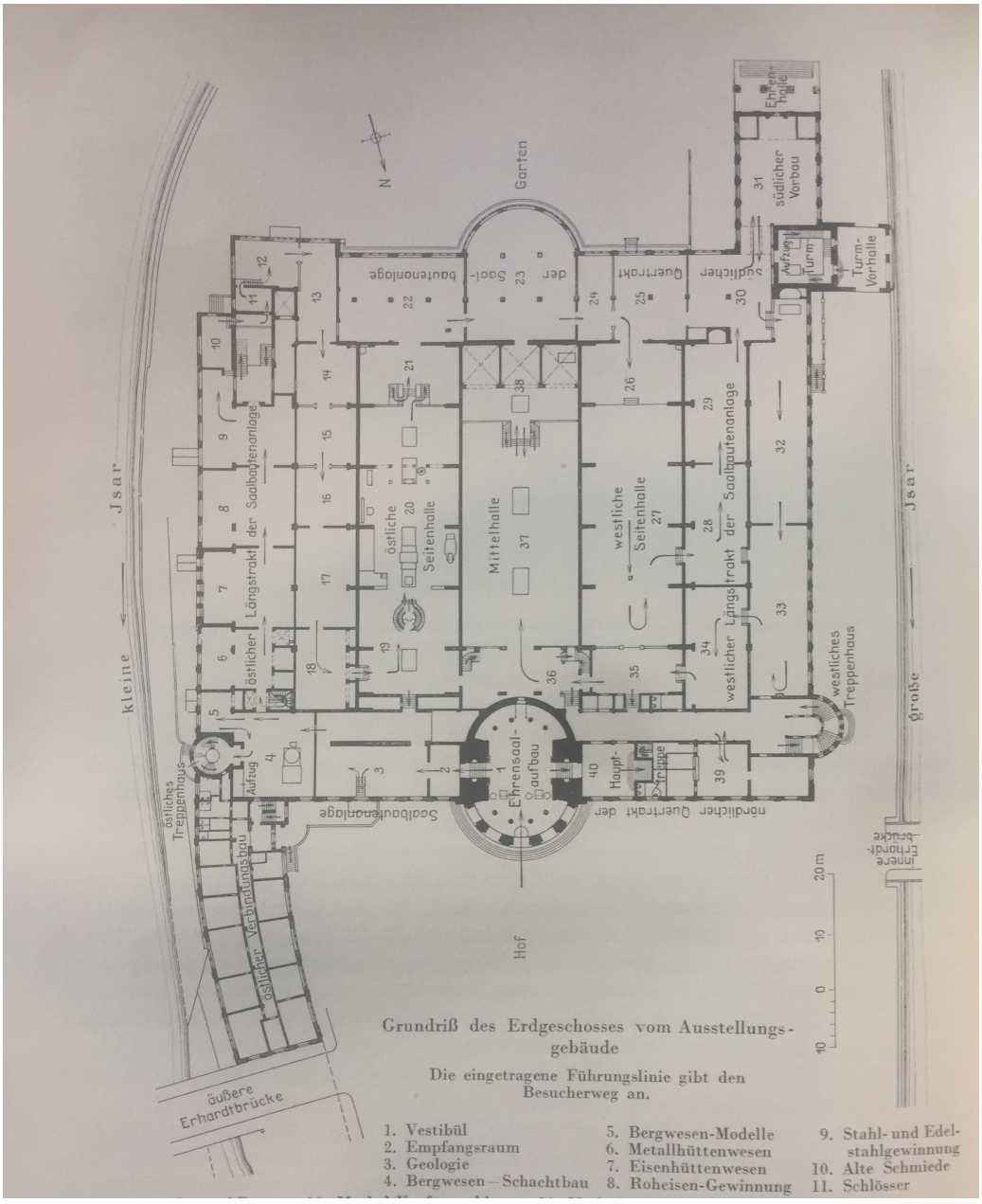


Figure 2.14 Seidl and von Miller's proposed ground floor floorplan. Courtesy Deutsches Museum Archives.

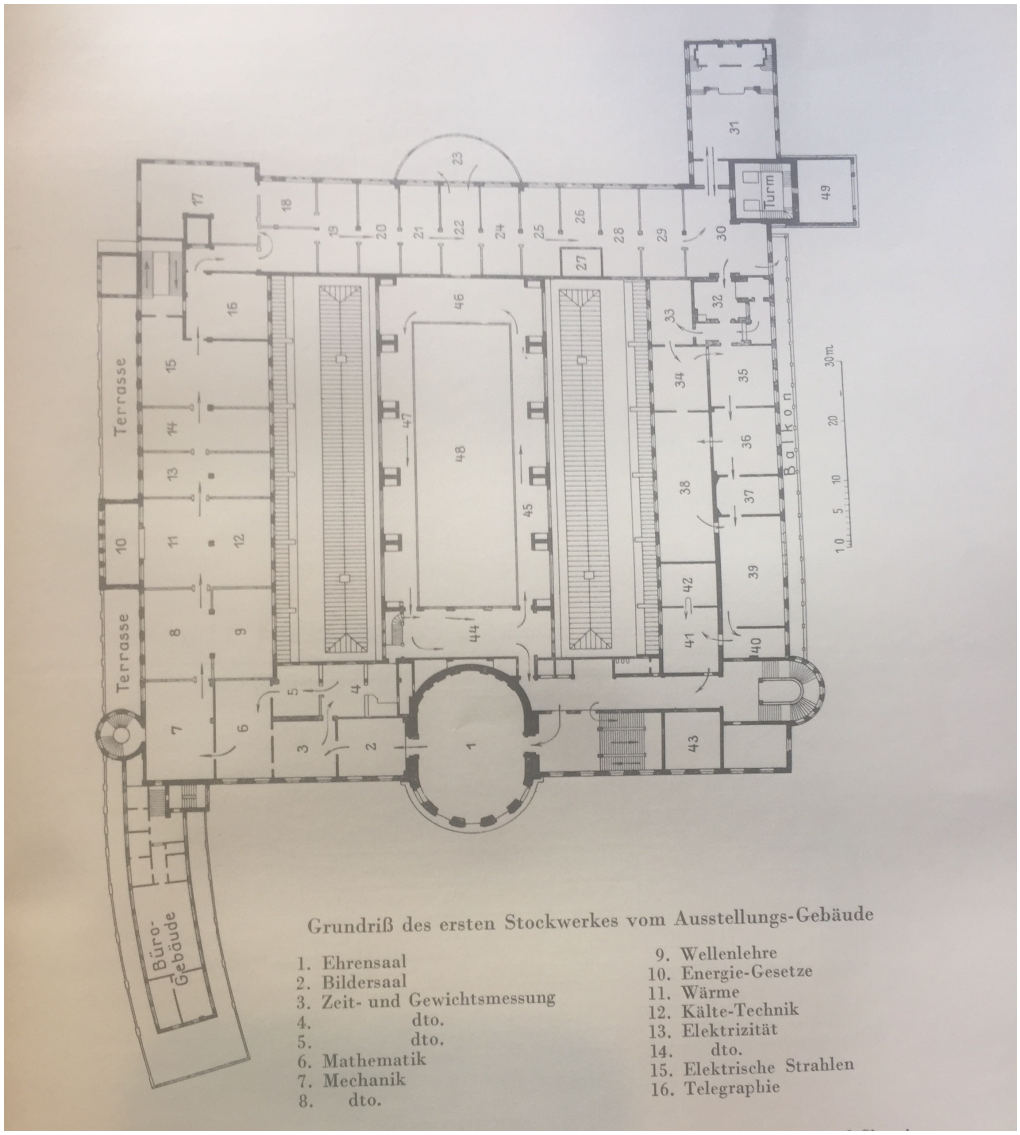


Figure 2.15. Proposed second floor floorplan. Note the arrows indicating movement. Courtesy Deutsches Museum Archives.

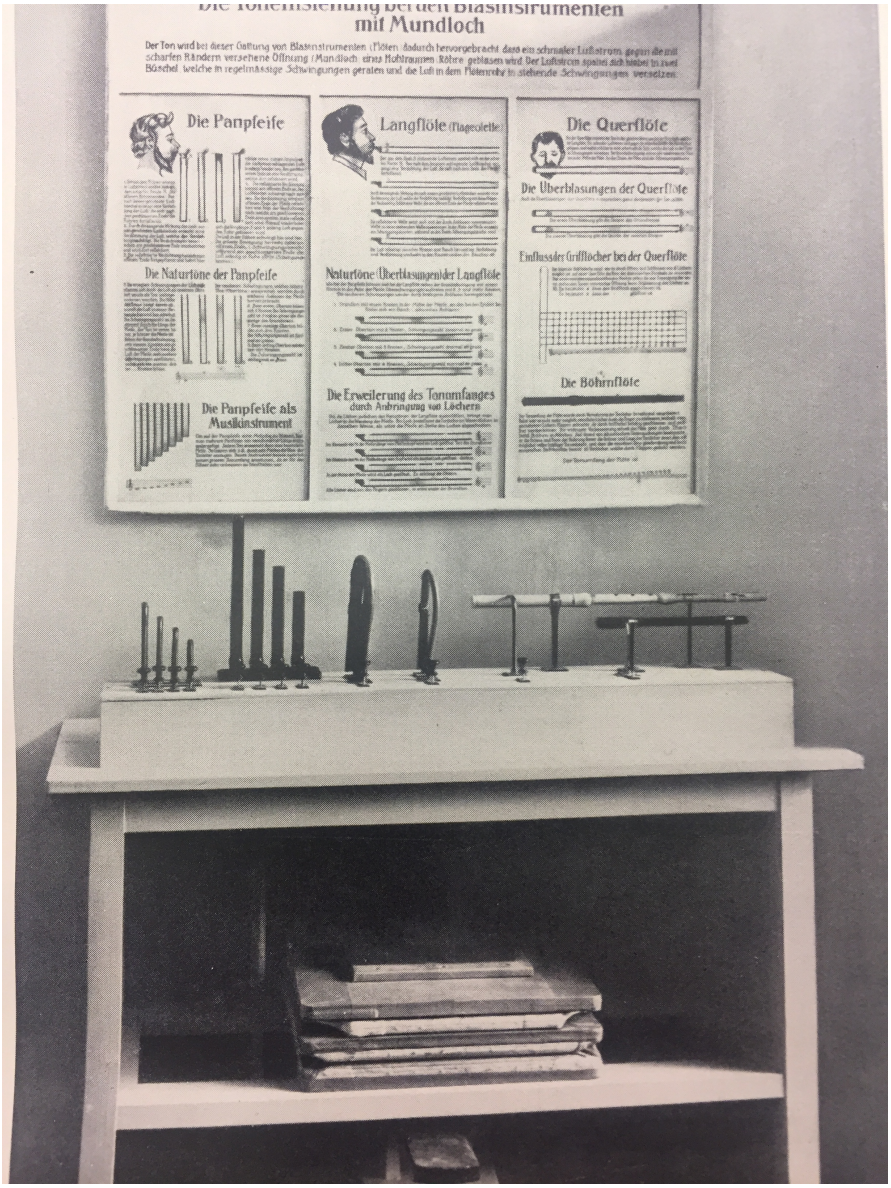


Figure 2.16 Interactive station in the historical instrument collection. Visitors could blow over the pipes on the left to produce different sounds. Courtesy Deutsches Museum Archives.

Figure 2.17 16th century alchemist's lab in the Chemistry wing of the museum. Courtesy Deutsches Museum Archives.

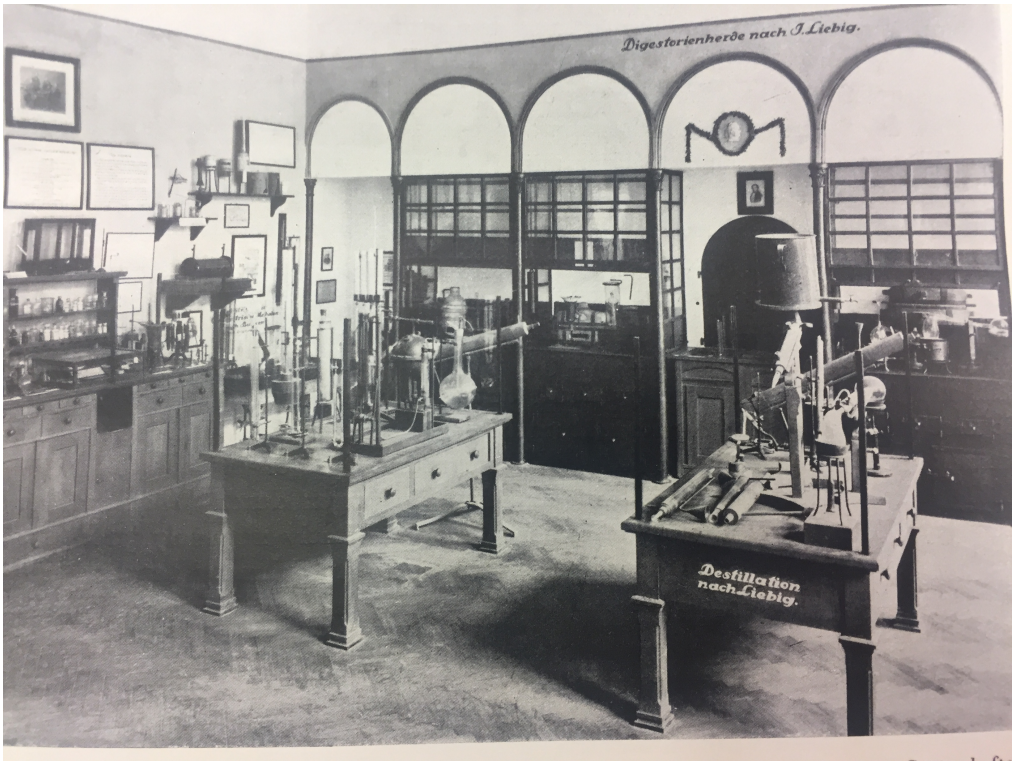


Figure 2.18 Reconstruction of a mid-19th teaching laboratory modeled after Justus von Liebig's, in the Chemistry wing. Courtesy Deutsches Museum Archives.

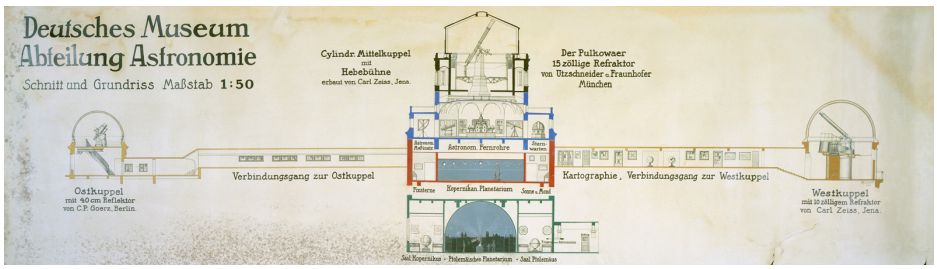


Figure 2.19, above. Floorplan of the Astronomy department floors. The Ptolemaic planetarium is at the bottom of the three-story department, with the Copernican planetarium above.
Figure 2.20, below. Central column of Astronomy department overlaid on a photograph of the building. The *Ehrensaal* would stand below.
Both images courtesy of Gerhard Hartl, Deutsches Museum. Gift to the author.

Figure 2.21 The Russell tabletop orrery. The whole diameter of the apparatus reached eleven feet, making it the largest orrery of its time, and for most of the 19th century.
Courtesy Wesleyan University Special Collections.

Figure 2.22 The Ptolemaic (geocentric) globe built by Sendtner for the Deutsches Museum, 1912. Courtesy Max Planck Institut für Wissenschaftgeschichte.

Figure 2.23 Copernican (heliocentric) orrery globe built by Sendtner for the Deutsches Museum, 1912. Courtesy Deutsches Museum Archives.

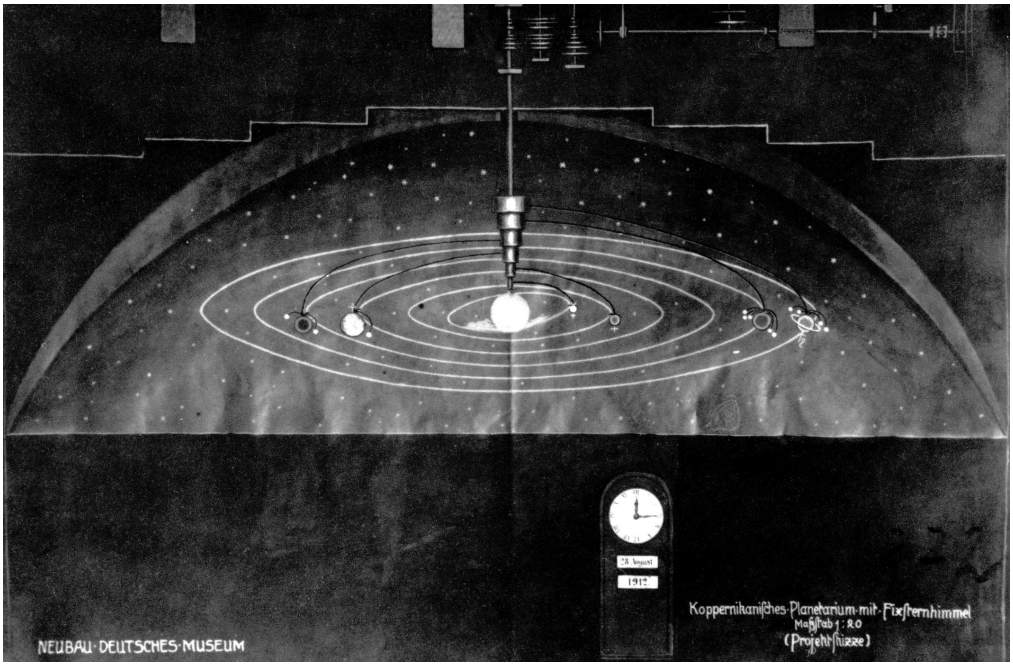


Figure 2.24 Sendtner's original design for the Copernican ceiling-mounted planetarium. All celestial bodies rotate from a central hanging axis. Courtesy Deutsches Museum Archives.

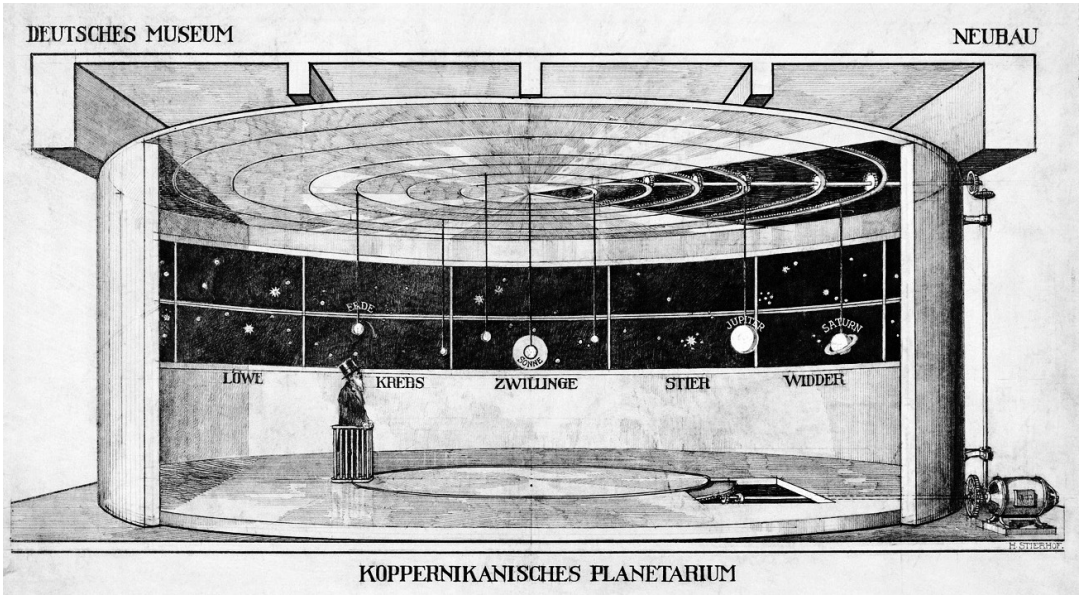


Figure 2.25 Revised Copernican planetarium design with movable track underneath Earth. Courtesy Deutsches Museum Archives.

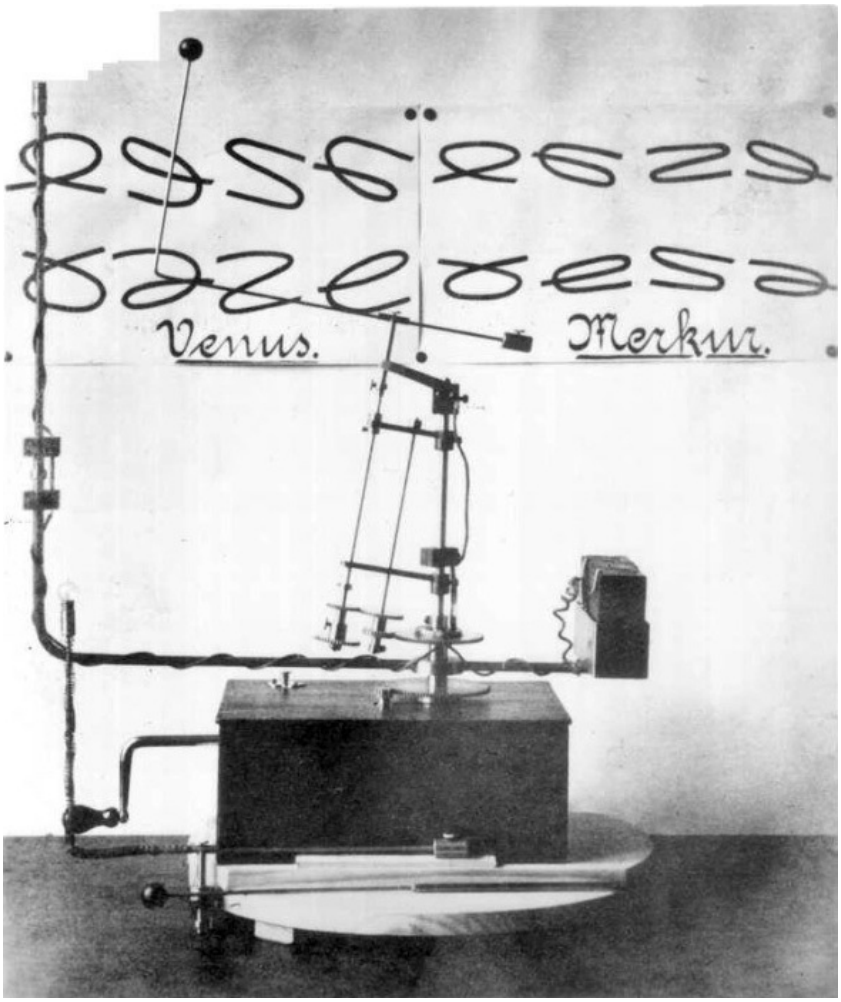
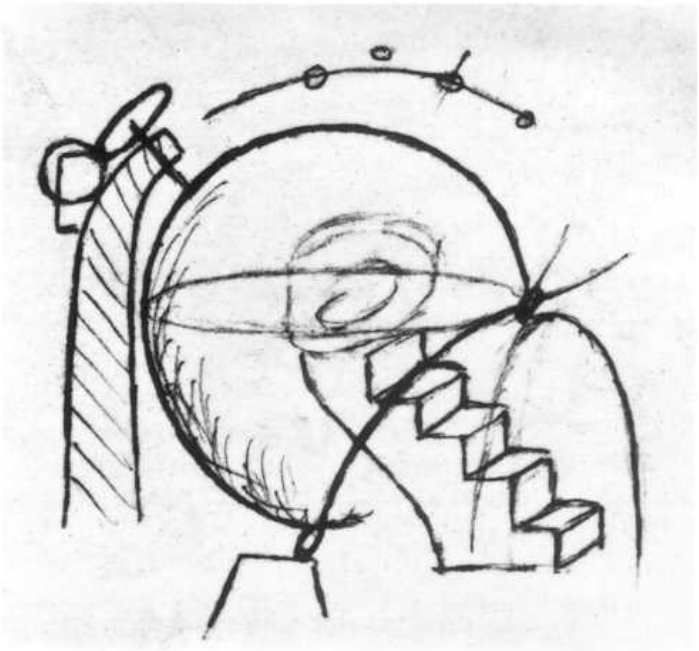


Figure 2.26 Hindermann's Orbitoscope. The loops visible behind the apparatus are sketches of the shadows cast by the planets at different positions. Courtesy Deutsches Museum Archives.

Figure 2.27, Above. Sketch of Oscar von Miller inside Max Wolf's original Ptolemaic planetarium design.
Figure 2.28, Below. Another of Wolf's sketches of his preliminary planetarium model. Both images courtesy Deutsches Museum Archives.



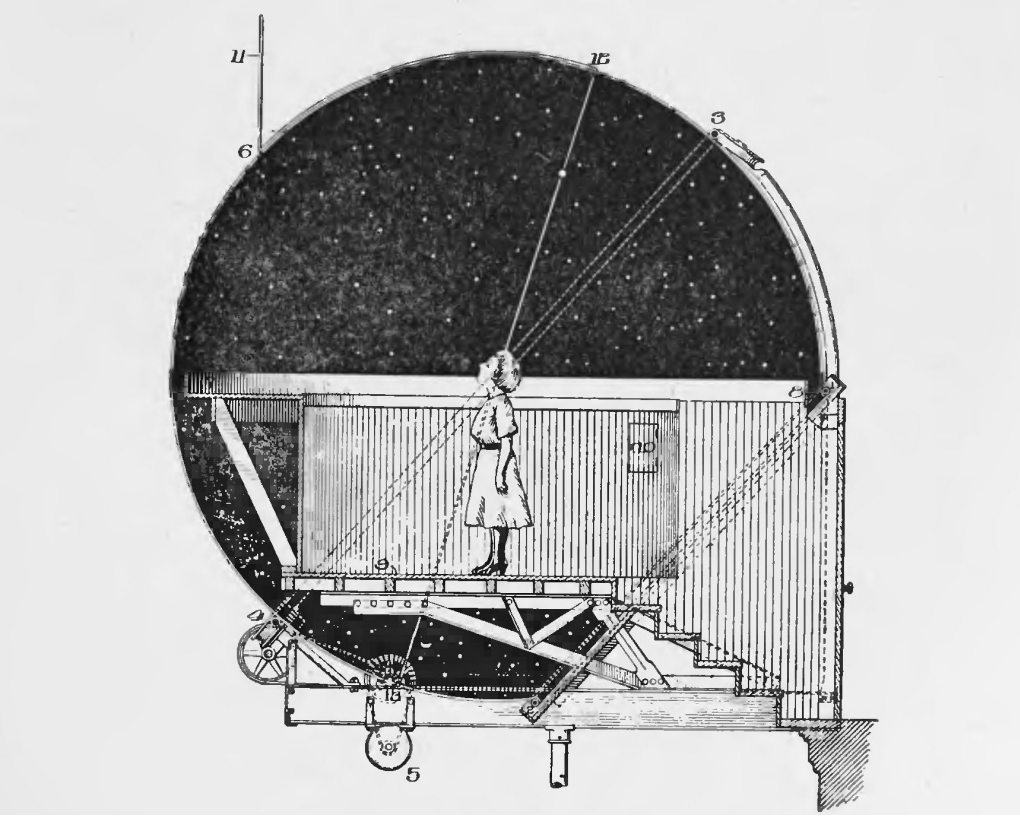


Figure 2.29 The Atwood Sphere. Adler Planetarium, Chicago. Courtesy Adler Planetarium.

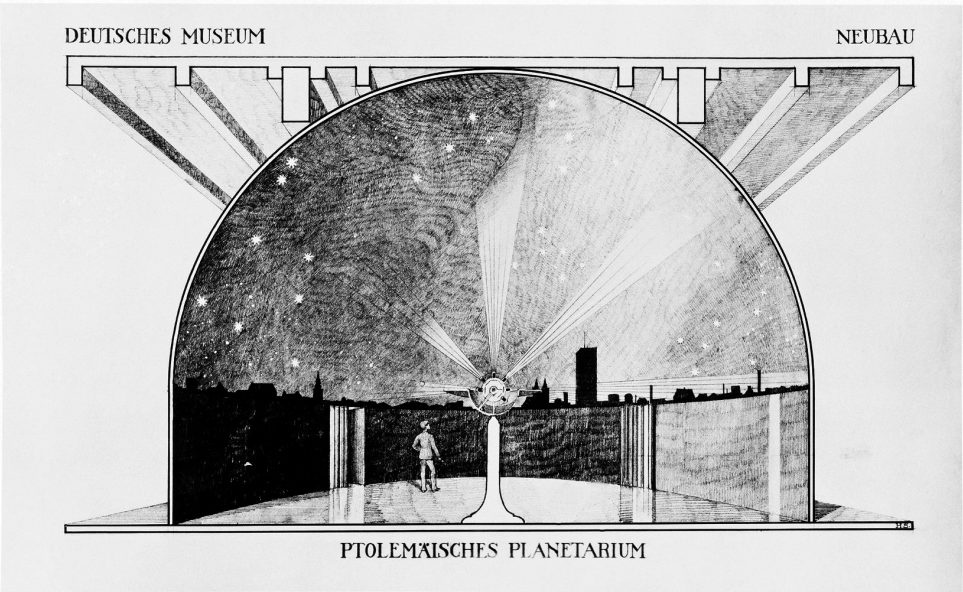
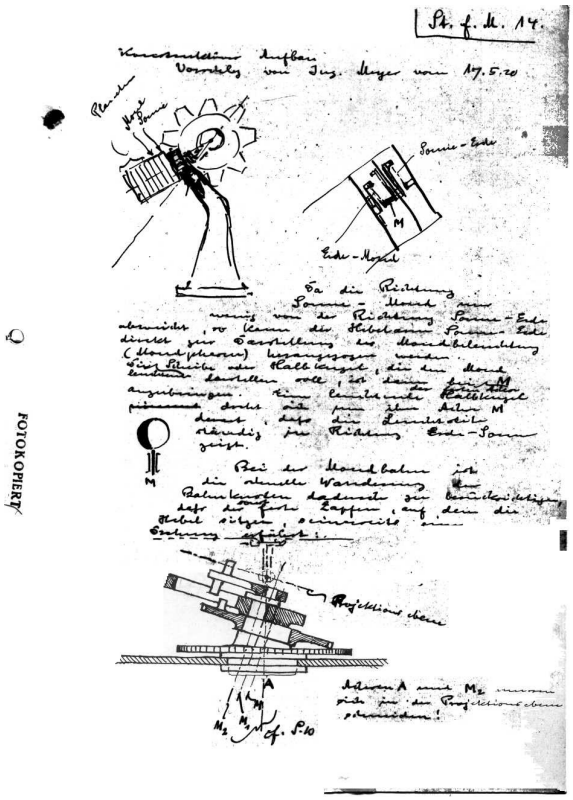


Figure 2.30, Above. Early proposed projection design, 1916.
Figure 2.31, Below, Walter Bauersfeld's sketch for a projection apparatus. Both images courtesy of Deutsches Museum Archives.



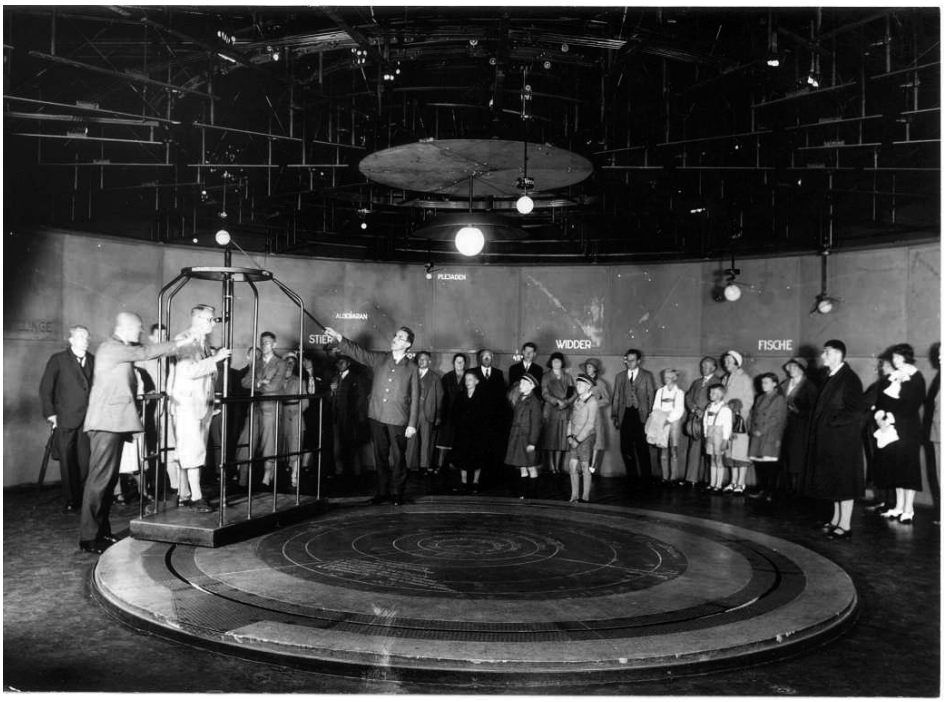


Figure 2.32 The Copernican planetarium in 1925, with a visitor standing on the movable track below Earth. Courtesy Deutsches Museum Archives.

Figure 2.33 The Ptolemaic planetarium in the museum dome. Note the small skyline silhouette of Munich along the horizon. Courtesy Deutsches Museum Archives.

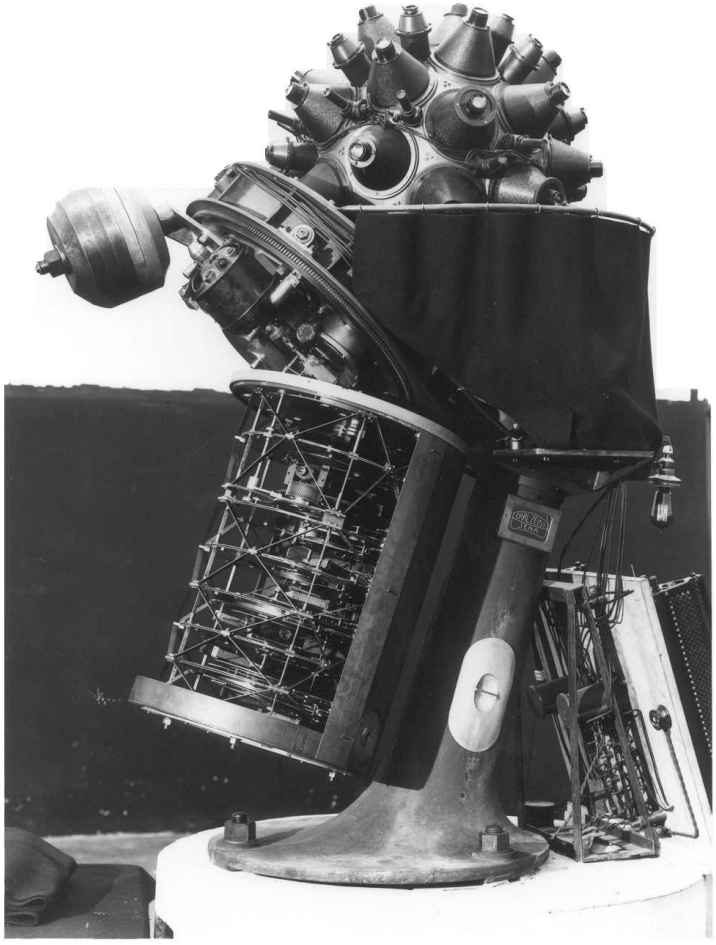


Figure 2.34 The Ptolemaic planetarium projector. The planets, ecliptic, equator, and moons were projected from the cylinder, while the sphere contained all lenses for stars. Courtesy Deutsches Museum Archives.

CHAPTER II: The Wonder of Jena

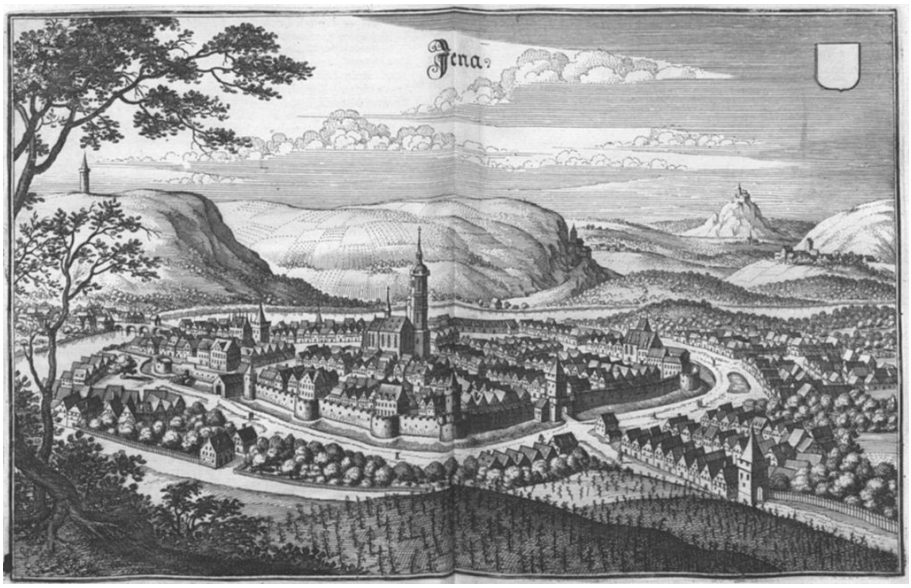
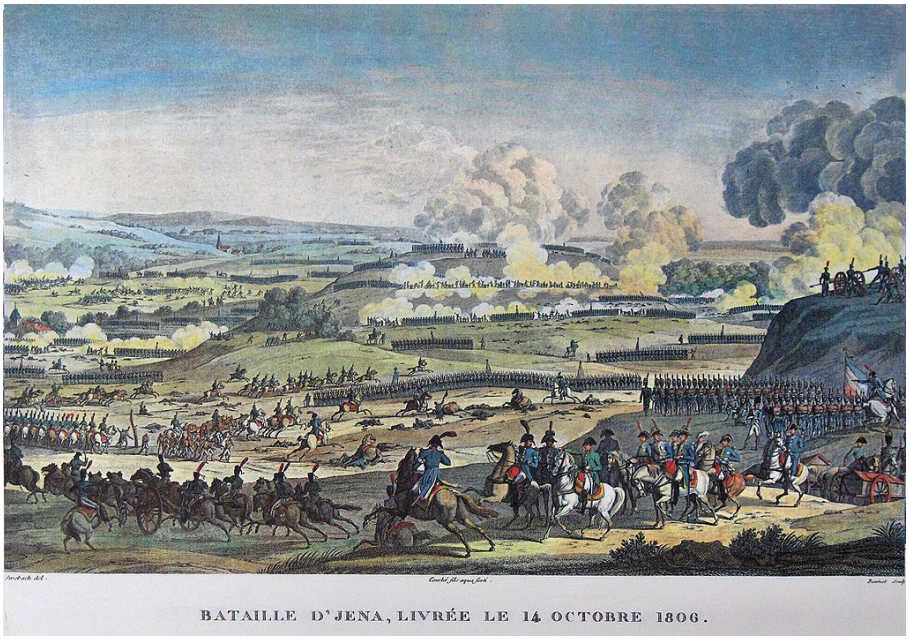


Figure 3.1, above. Jena circa 1650. Courtesy Wikimedia Commons.
Figure 3.2, below. Battle of Jena, 1806. Courtesy Wikimedia Commons.



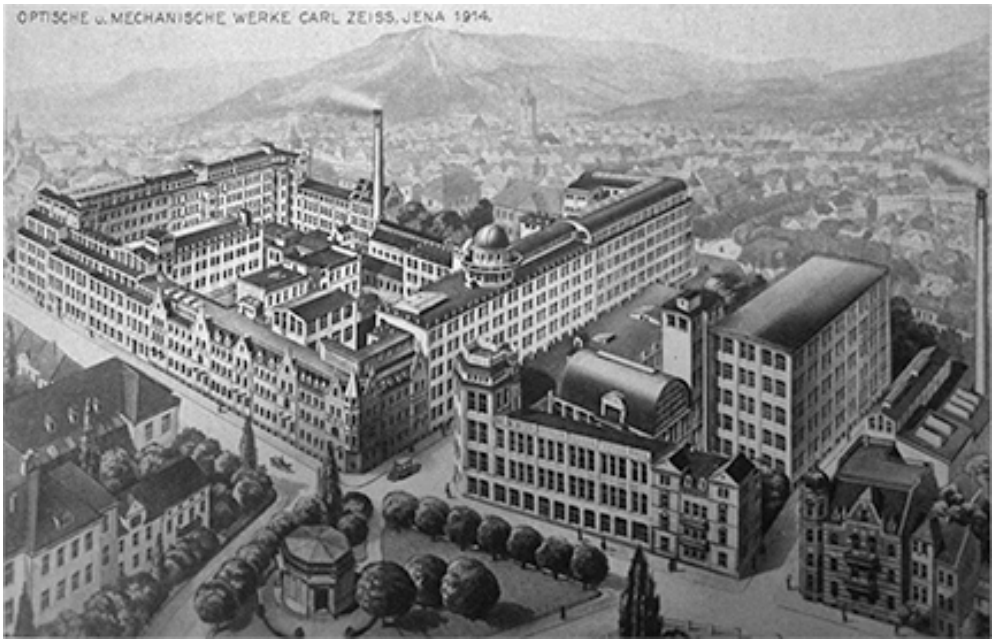


Figure 3.3, above. Carl Zeiss Company in the center of Jena, 1914. Courtesy Carl Zeiss Archive.
Figure 3.4, below. Carl Zeiss Company buildings in Jena, c. 1925. Courtesy Carl Zeiss Archive.

Figure 3.5 Construction of the prototype dome on the roof of the Carl Zeiss Company. Courtesy Carl Zeiss Archive.

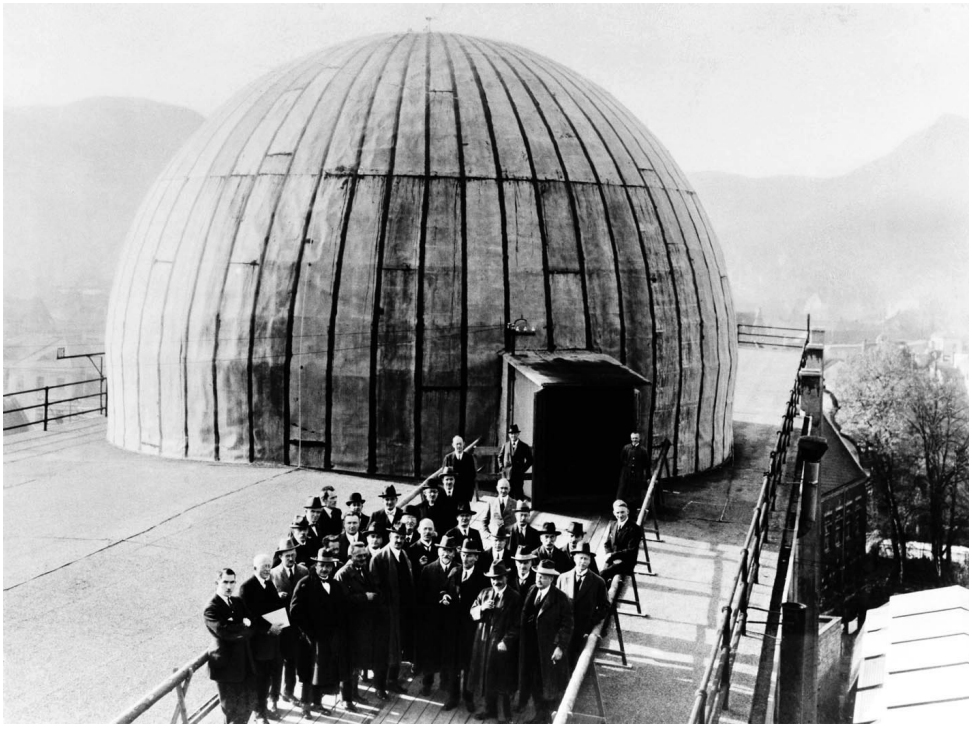


Figure 3.6 Visitors attending a performance of the prototype Mark I projector on the roof of the Carl Zeiss Company. Courtesy Carl Zeiss Archive.

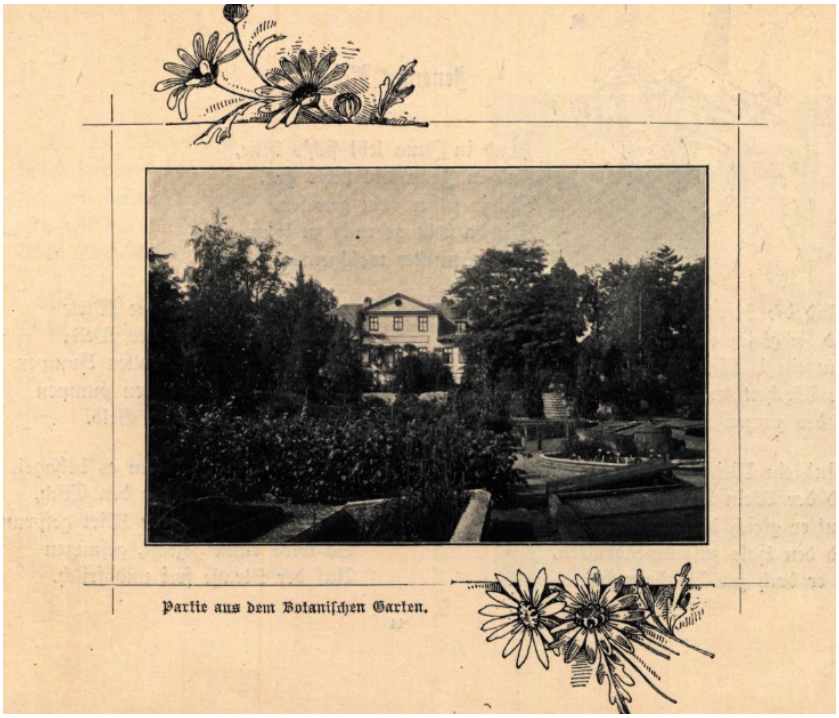
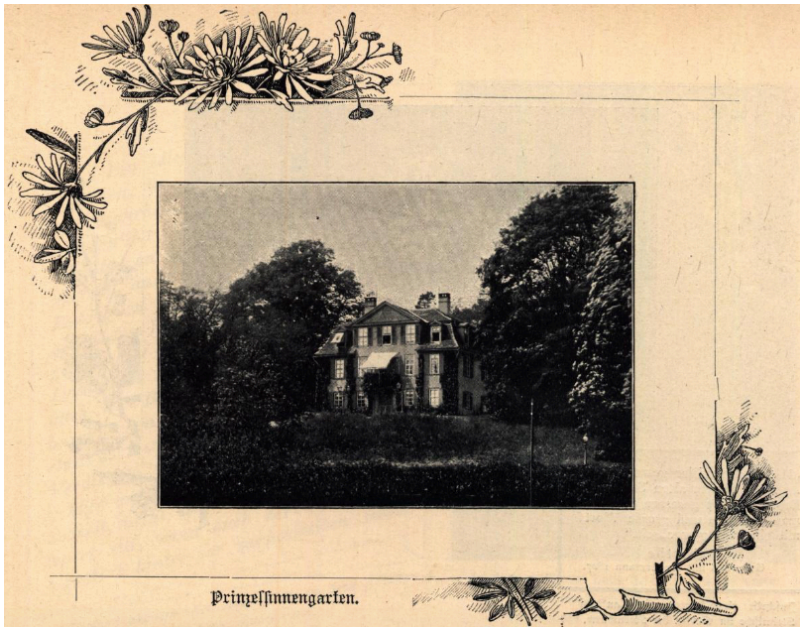


Figure 3.7, above. Photograph of the main house of the Botanical Gardens, next to the Prinzessinnengarten grounds that became the proposed site of the planetarium.
Figure 3.8, below. The cottage at the center of the Prinzessinnengarten grounds
Both images from the 1897 photography book *Jena in Wort und Bild*. Courtesy of Thüringer Universitäts- und Landesbibliothek.



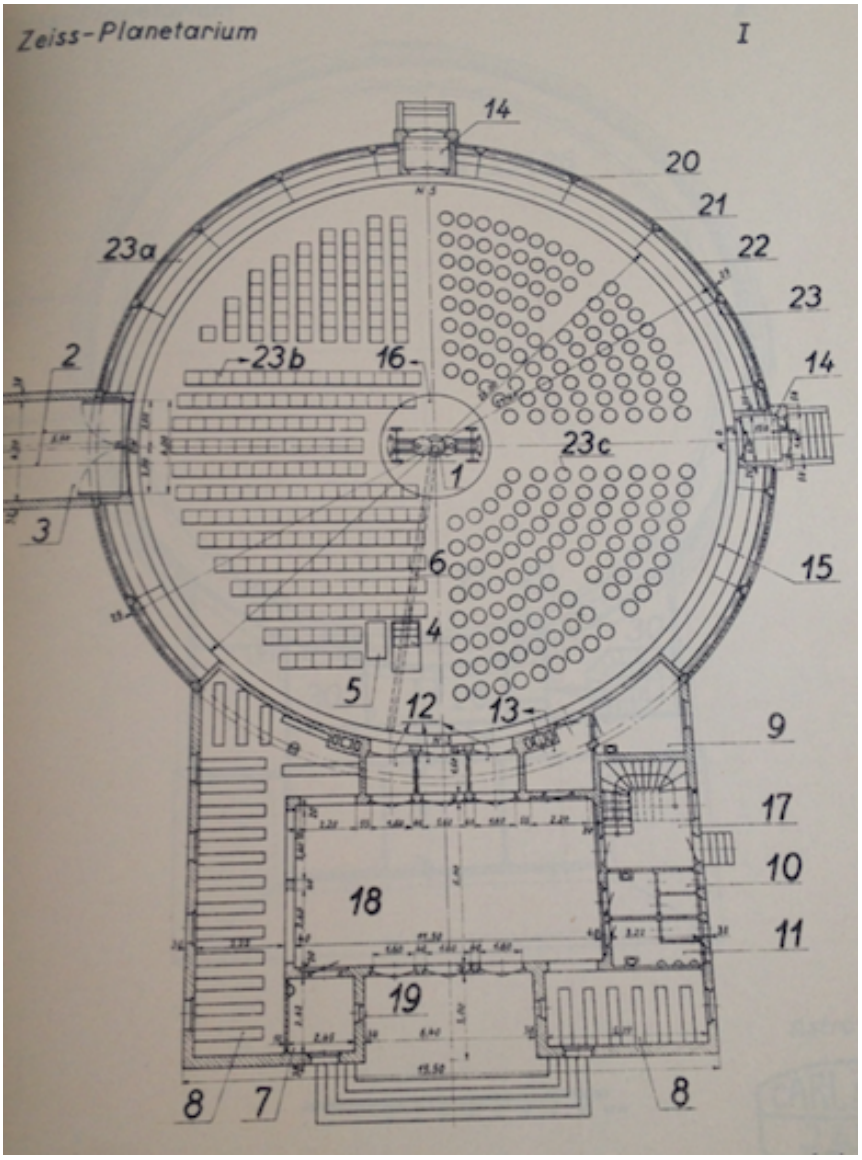


Figure 3.9 Floorplan for the Jena Planetarium. Courtesy Carl Zeiss Archive.

Figure 3.10, above. Painting of the Zeiss Planetarium in the Prinzessinnengarten, 1928. Courtesy of Carl Zeiss Archive.

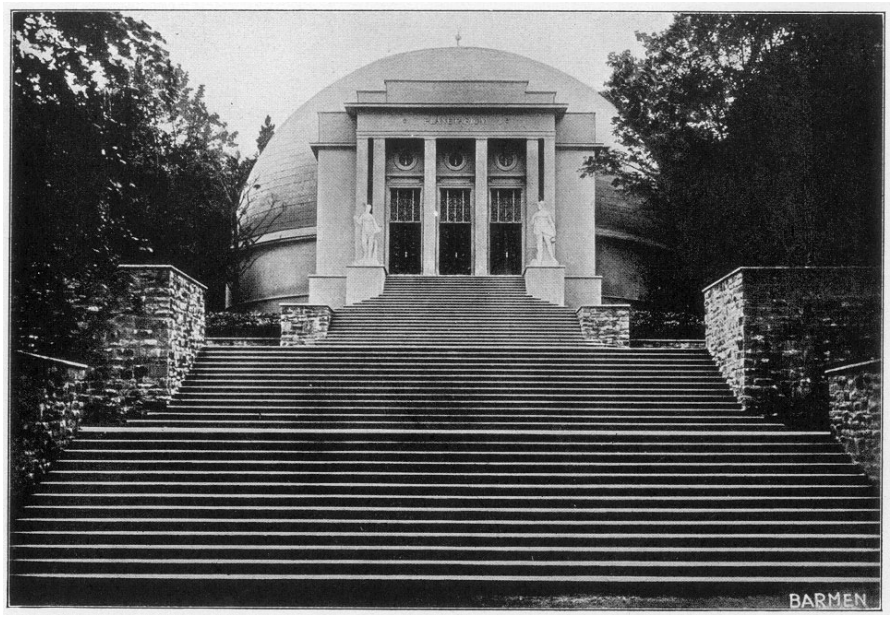


Figure 3.11, above. The Barmen planetarium.
Figure 3.12, below. The Leipzig planetarium.
Both images courtesy of Karlheinz Rohrwild, gift to the author.

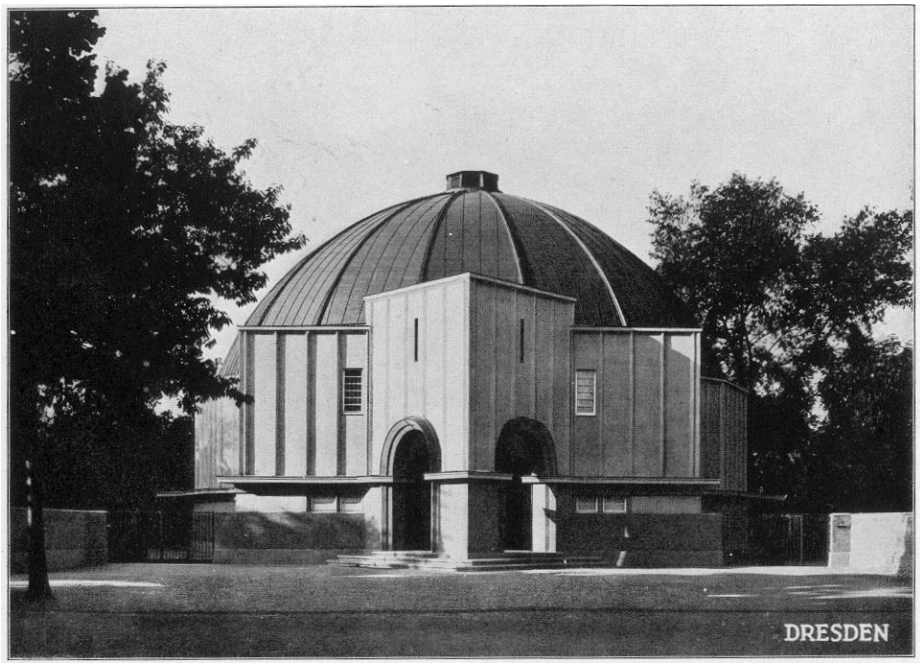


Figure 3.13 Dresden planetarium. Courtesy of Karlheinz Rohrwild, gift to the author.

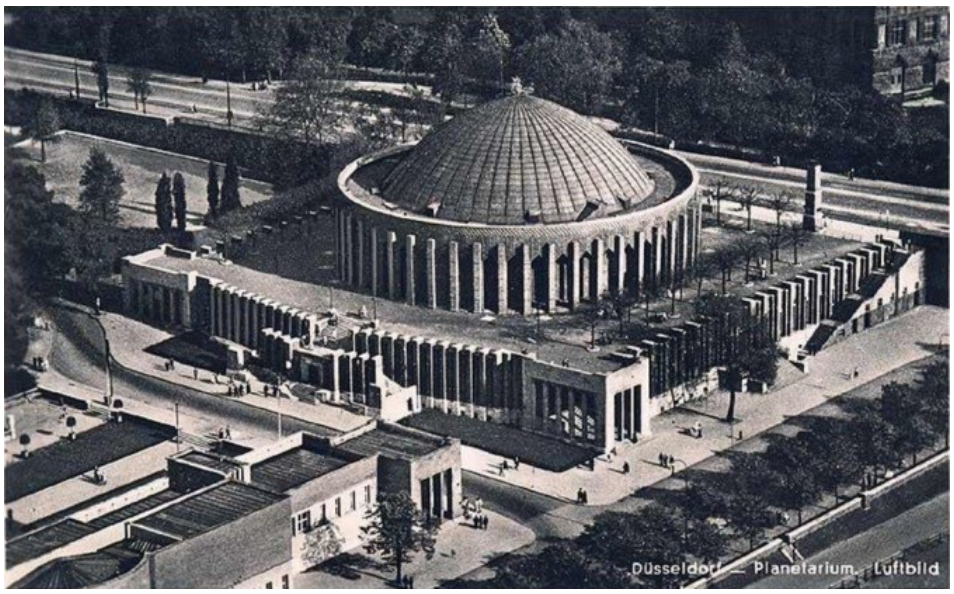
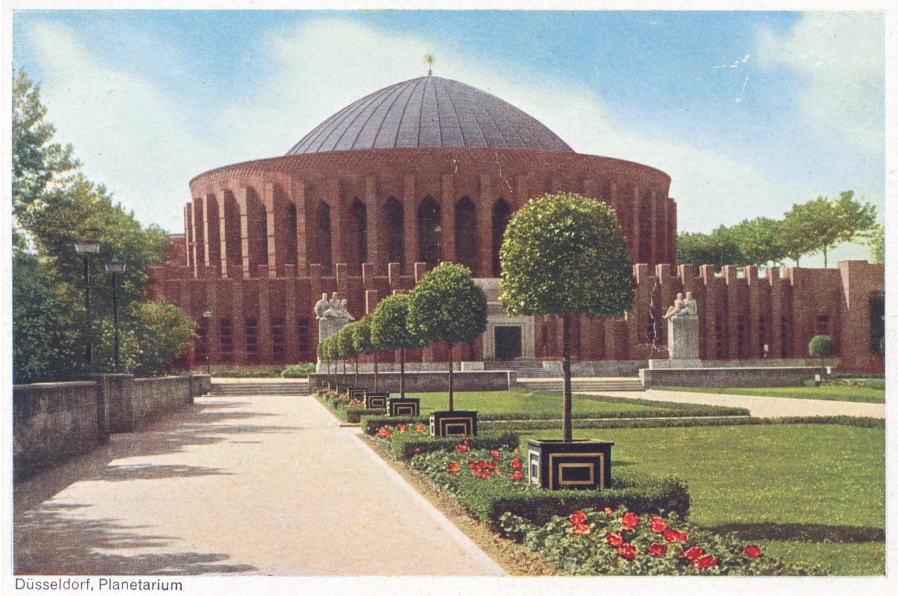


Figure 3.14, above. Düsseldorf planetarium, probably 1926.
Figure 3.15, below. Another view.
Both images courtesy of Karlheinz Rohrwild. Gift to the author.



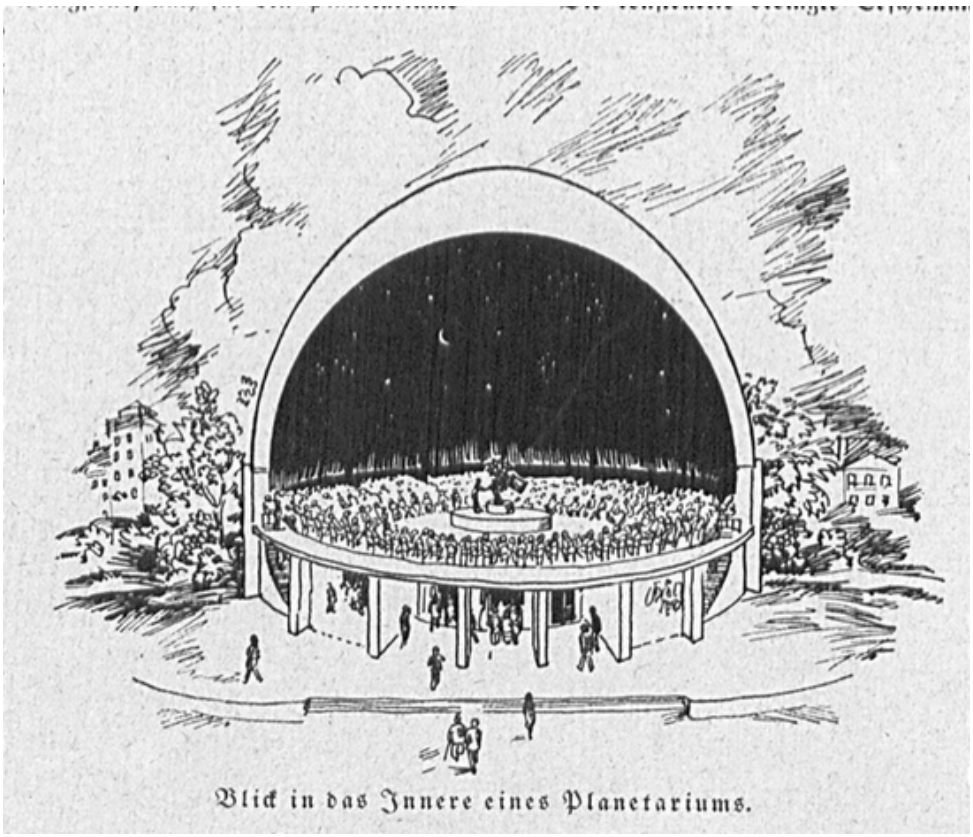
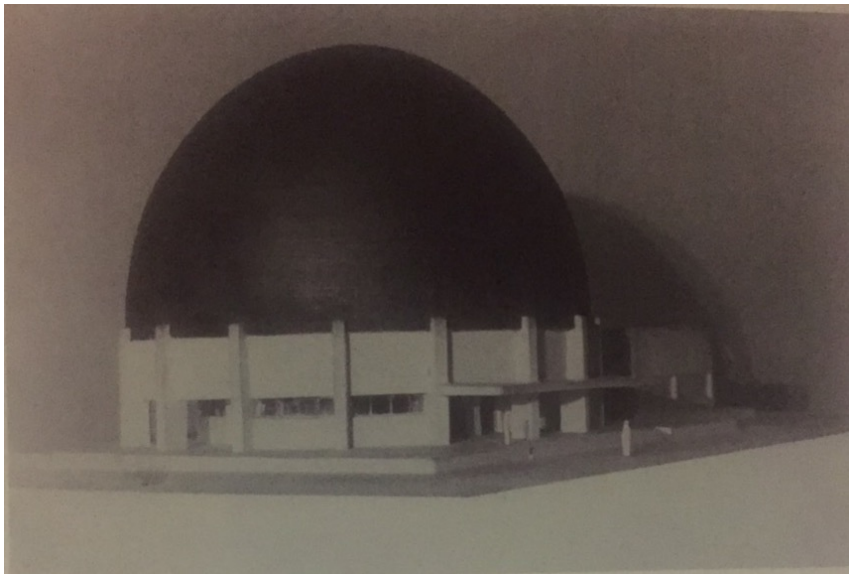


Figure 3.16, above. Adolf Meyer's vision for a Bauhaus planetarium. In Walter Dexel's *Reclam Universim* article on the subject. Courtesy of the Staatsbibliothek Berlin.
Figure 3.17, below. Adolf Meyer's planetarium design. Courtesy Carl Zeiss Archive.



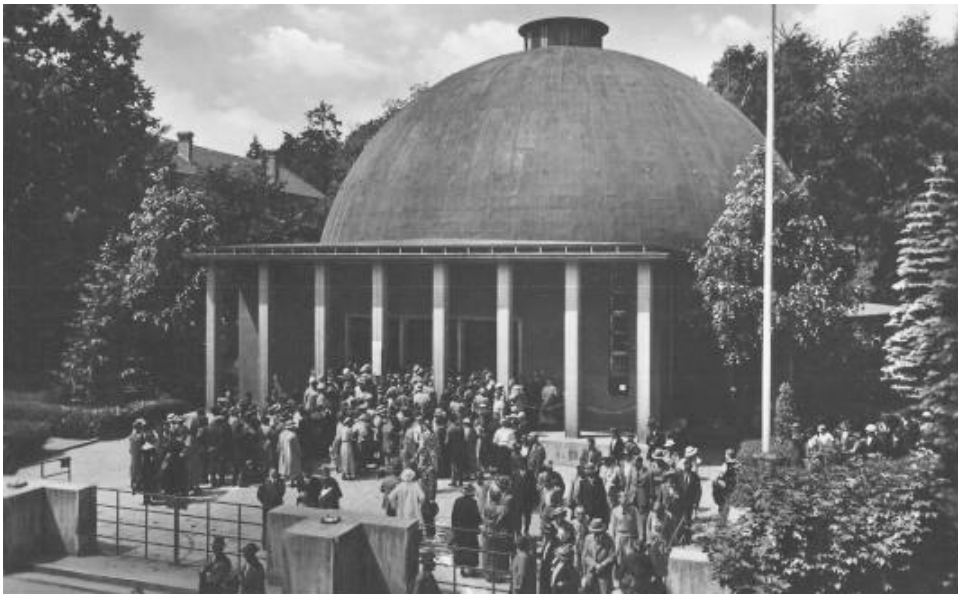
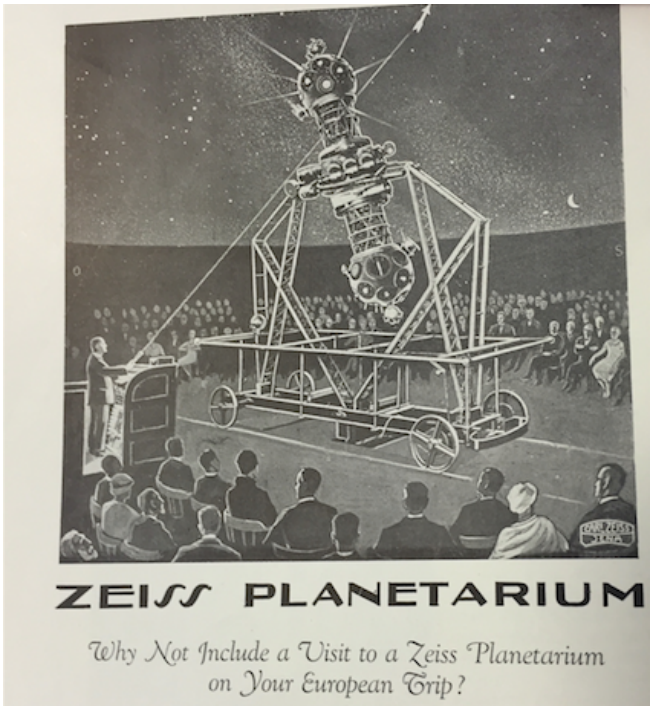


Figure 3.18 Opening Day crowds at the planetarium. Courtesy Carl Zeiss Archives.

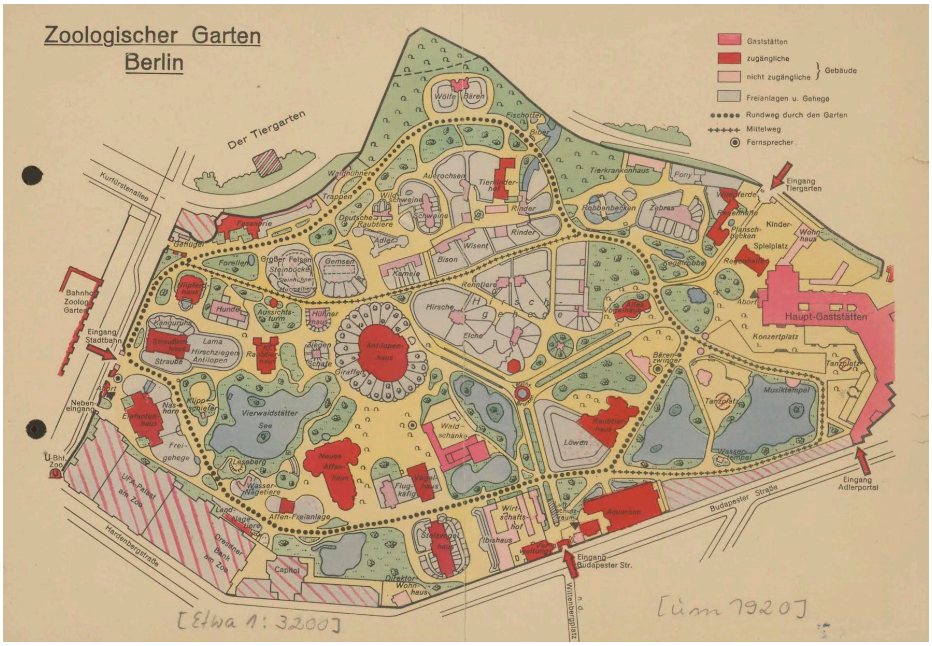


Figures 3.19, above, and 3.20, below. The international reach of the Zeiss planetarium. Above, an excerpt of a brochure to be distributed in New York. Below, an advertisement claiming that the planetarium can be found all over the world. Both courtesy of the Carl Zeiss Archive.

CHAPTER III : “Zum Planetarium”

Figure 4.1 Crowds assembling outside the Berlin planetarium for its grand opening. Courtesy Carl Zeiss Archive.

Figure 4.2 above. Tourist map of Berlin, 1927, closeup. Planetarium circled.
Figure 4.3 below. Map of Zoologischer Garten, c. 1925 (erroneously labeled as 1920). The train station is suggested in the far left. A space for the planetarium is visible in the top left corner.
Both images courtesy of the Staatsbibliothek Berlin.



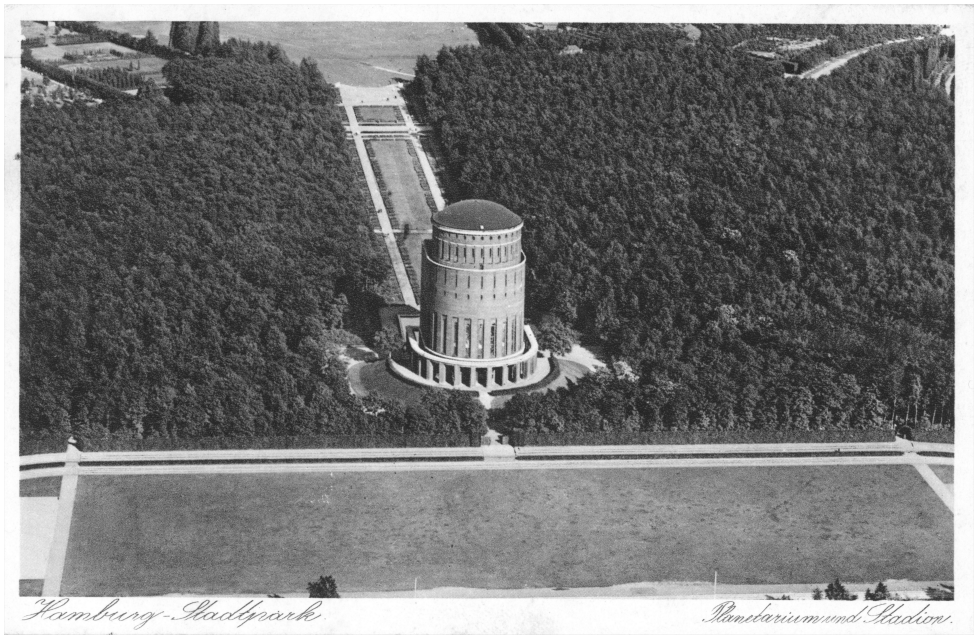


Figure 4.4 Aerial view of the Hamburg planetarium, 1930 or 1931. Courtesy of Karlheinz Rohrwild, gift to the author.

Figure 4.5 above. The UFA-Palast cinema, as seen from underneath the Zoo station. The Elephant House of the Zoo is visible to the left in the background.
Figure 4.6 below. Colorized aerial view of the Gedächtniskirche. The UFA-Palast is directly behind and to the left of the church, with the Elephant house visible just to the left of the church's spire. The planetarium dome is visible at the top of the image just right of center.
Both images courtesy of the Staatsbibliothek Berlin.

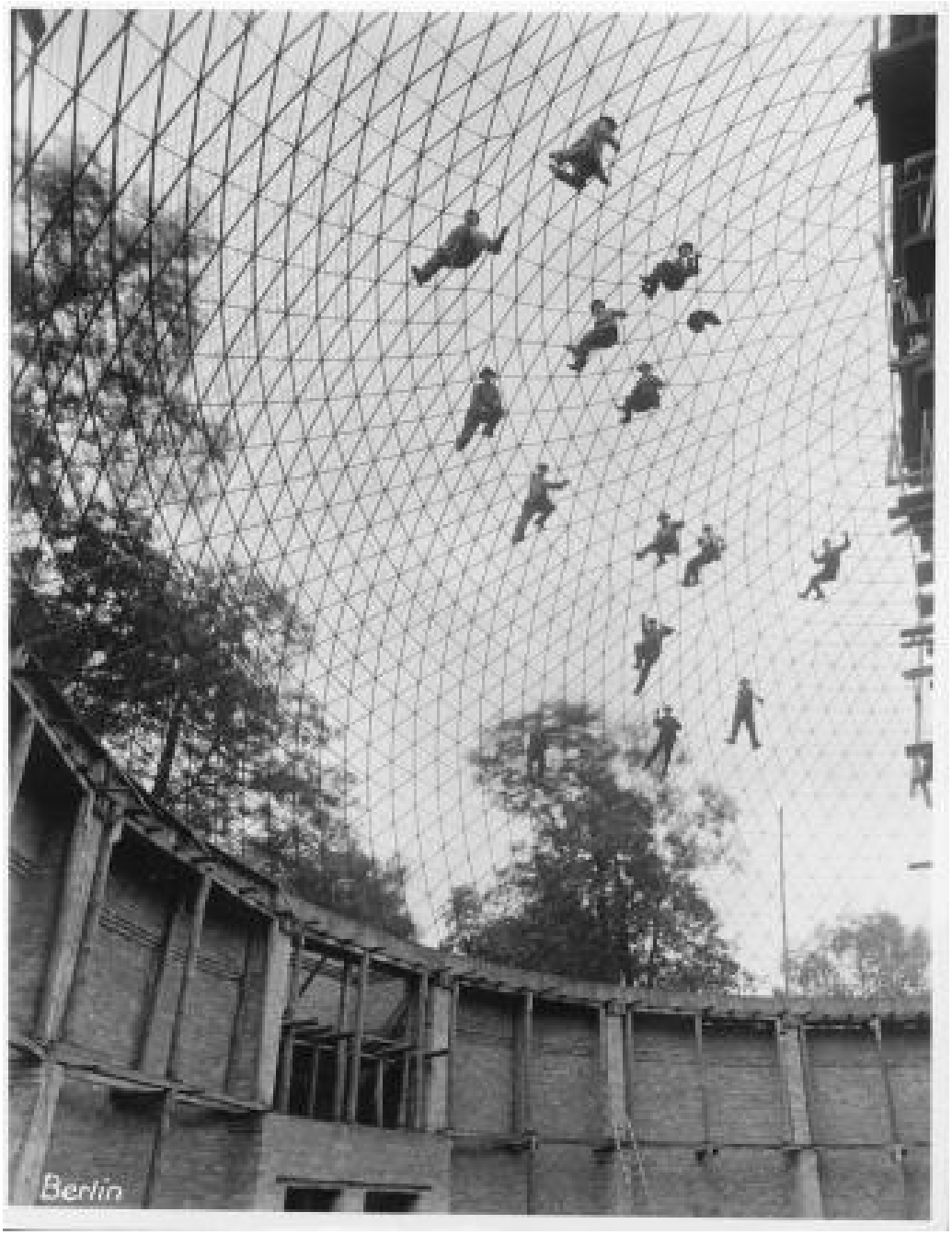


Figure 4.7 Workers stretching dome network at the Berlin planetarium construction site. Courtesy Carl Zeiss Archive.

Figure 4.8 The Urania at its Taubenstrasse address, 1915. Staatsbibliothek Berlin. Courtesy Staatsbibliothek Berlin

Figure 4.9 A lecture to schoolchildren in the Berlin planetarium, August 1928. Note the moveable, straight-backed chairs. Fixed, reclining chairs were not installed until after the war. Carl Zeiss Archive.

Figure 4.10, above. UFA-Palast illuminated at night, 1920s.
Figure 4.11, below. Sign for the Berlin im Licht festival.
Both images courtesy of the Staatsarchiv Berlin.

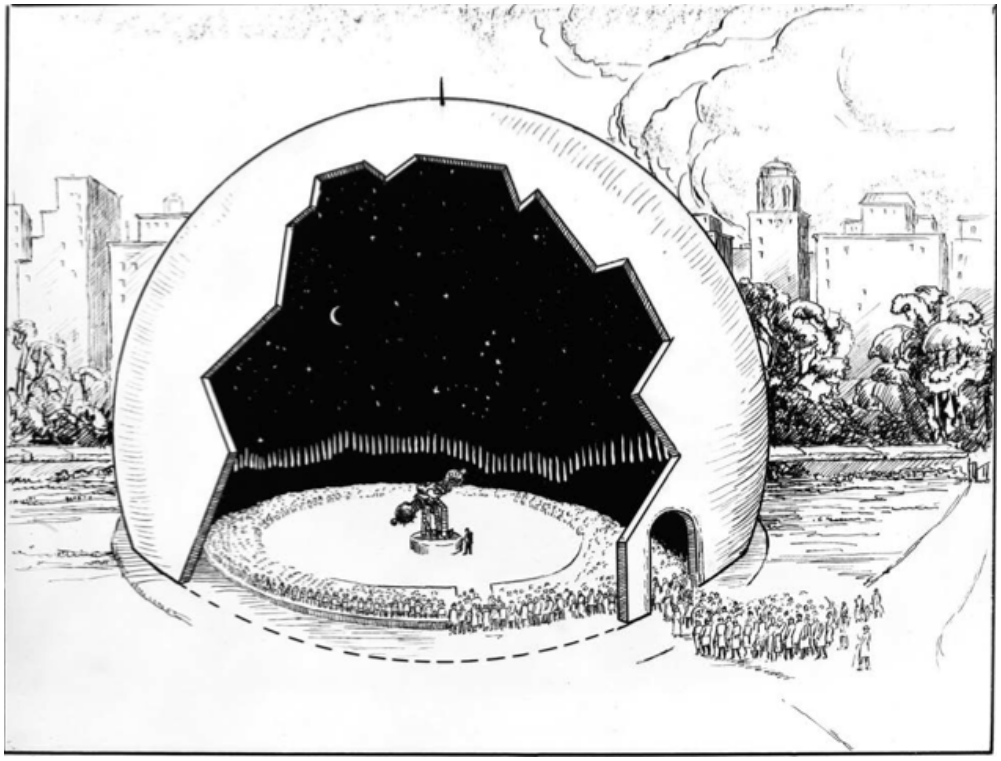


Figure 4.12 Sketch of a planetarium in the heart of a city. Undated and untitled. Courtesy American Natural History Museum Archives.

CHAPTER IV: Under Germanic Skies

Figure 5.1 Three hundred party officials assemble outside the Jena planetarium. Courtesy Carl Zeiss Archive.

Figures 5.2, above, and 5.3, below. Nazi party officials mingle at the Jena planetarium. Courtesy Carl Zeiss Archive.

Figure 5.4 The Nuremberg planetarium, c. 1930. Courtesy of Karlheinz Rohrwild, gift to the author.

U-Boot-fahrer besuchten das Zeiß-Planetarium

Am 28. Februar besuchte ein Teil einer U-Boot-Mannschaft, die sich im Kampf gegen England besonders ausgezeichnet hat, unter Führung von Staatsrat SS-Gruppenführer Hennicke das Zeiß-Planetarium in Jena. Die Gäste wurden im Planetarium vom Rektor der Friedrich-Schiller-Universität, Staatsrat Prof. Dr. Astel und Prof. Dr. Bauersfeld empfangen. Prof. Bauersfeld begrüßte die U-Boot-Männer aufs herzlichste und gab dann einen kurzen Überblick über die Geschichte des Planetariums.

Die Anregung zum Bau eines solchen technischen Wunderwerkes ging von dem Heidelberger Astronomen Wolf aus. Geheimrat von Miller, der Gründer des Deutschen Museums in München, griff die Idee auf und unterbreitete sie der Firma Carl Zeiß, wo Prof. Bauersfeld mit seinen Mitarbeitern das Planetarium schuf, von dem es heute 13 in Deutschland und 14 im Ausland gibt.

Prof. Bauersfeld zeigte den U-Boot-Männern durch praktische Vorführungen Ausschnitte aus der Leistungsfähigkeit des Zeiß-Planetariums und erläuterte anschließend technische Einzelheiten des Projektionsapparates, für die sich seine aufmerksamen Zuhörer besonders interessierten.

Figure 5.5 U-Boat sailors visit the Jena planetarium, as reported in the *Zeiss-Werkzeitung* in 1941. Courtesy Carl Zeiss Archive.

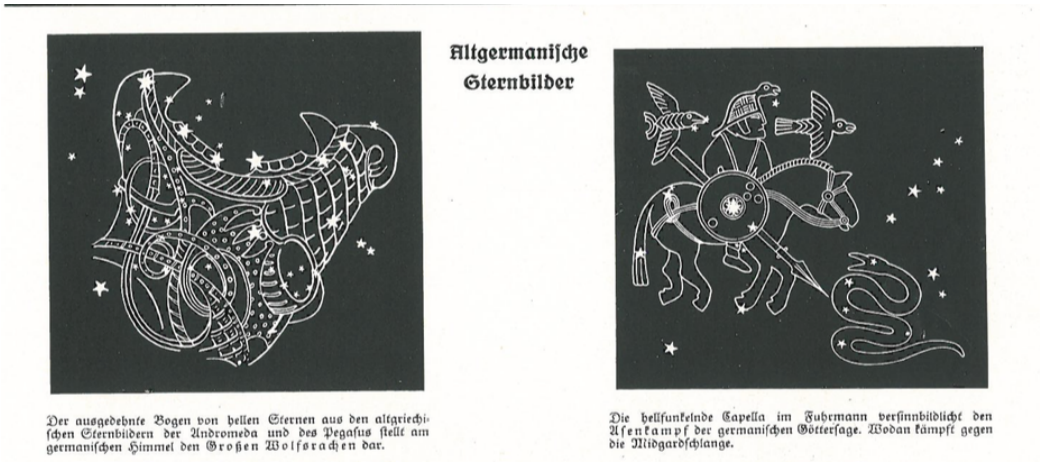


Figure 5.6 Two "altgermanisch" constellations that replaced traditional Greco-Roman constellations as part of the 1938 planetarium show "Schein und Sein im Wandel der Planeten." Courtesy Carl Zeiss Archive.

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Curriculum Vitae

Katherine Boyce-Jacino was born in Minneapolis, MN, on 11 January 1989. She graduated from Wesleyan University with honors in 2010, with a dual degree in History and Astronomy. She began her doctoral studies at the Johns Hopkins University Humanities Center (renamed the Department of Comparative Thought and Literature in 2017) in the fall of 2010, under the supervision of Ruth Leys. In 2011, she was a visiting scholar at the Max Planck Institute for the History of Science in Berlin. From 2013 to 2014, Katherine was a visiting doctoral student at the Freie Universität Berlin, in the Emmy-Noether Research Group "Die Zukunft in den Sternen: Europäischer Astrofuturismus und außerirdisches Leben im 20. Jahrhundert." She has also been the recipient of several Max Kade Travel Grants, several Cornelia Hohenberg Kaye Travel Grants, and the Johns Hopkins University Center for Advance Media Studies fellowship. From 2016 to 2017, she was the resident Guggenheim Fellow at the National Air and Space Museum in Washington, D.C., and in 2017-2018 she was in residence at the American Institute of Physics as an oral historian. As of the fall of 2018, she is an Honors Fellow at the Barrett Honors College at Arizona State University in Phoenix, AZ.

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